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PROJECT TECHNICAL REPORT

TASK E&DD-702C

TRW VORTEX-LATTICE METHOD SUBSONIC AERODYNAMIC ANALYSIS FOR MULTIPLE-LIFTING-SURFACES (N. SURFACE) TRW PROGRAM NUMBER HA010B

NAS 9-12330 | 1 SEPTEMBER 1972

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

Prepared by
Applied Mechanics Department

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TRW
SYSTEMS

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TRW
SYSTEMS

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ABSTRACT

This manual provides a condensed users description and theory for TRW's Vortex-Lattice Method Subsonic Aerodynamic Analysis for Multiple-Lifting-Surfaces (N. Surface) Program HA010B. The program is designed to provide solutions of engineering accuracy for determining the aerodynamic loads on single- or multiple-lifting-surface configurations that represent vehicles in subsonic flight, e.g., wings, wing-tail, wing-canard, lifting bodies, etc. The manual describes the preparation of the input data, associated input arrangement, and the output format for the program data, including specification of the various operational details of the program such as array sizes, tape numbers utilized, and program dumps. As supplementary information, the manual includes a full description of the underlying theory used in the program development and a review of the program qualification tests.

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LIST OF SYMBOLS[†]

AR	aspect ratio
b	span
$B(X,Y,Z)$	the first of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
C	chord
$\overline{C}$	mean geometric chord (MGC), $\overline{C} = \frac{1}{S} \int_{-b/2}^{+b/2} C^2 \, dY$
C_D	wing drag coefficient
c_d	section drag coefficient
CF	aerodynamic cleanness factor
c_F	force coefficient
c_h	section hinge moment coefficient
C_L	wing lift coefficient
c_ℓ	section lift coefficient
$c_{\ell_{al}}$	additional section lift coefficient
c_{ℓ_b}	basic section lift coefficient
C_M	wing moment coefficient
c_m	section moment coefficient
Cn	n = 1,2,3,..., constants
C_N	wing normal lift coefficient
c_n	section normal lift coefficient
c_p	pressure coefficient, $c_p = (p - p_\infty)/q_\infty$
C_T	wing thrust coefficient

[†]Note: Symbols defined in the text may be omitted from this list.

LIST OF SYMBOLS (Continued)

c_t	section coefficient for thrust
C_X	force coefficient for X direction component
c_x	section coefficient for force acting in the X direction
D(X,Y,Z)	the second of two coordinate points that define the shape and location of a skew-shaped horseshoe vortex filament.
F	force
F_n	n = 1,2, 3,...., etc., constants
h	height above the ground plane
K	total number of elemental panels
L	lift
ℓ	length increment
M	Mach number
$\bar{m}$	lift slope
p	pressure
P(X,Y,Z)	coordinates of a field point for which the induced-velocity vector is calculated.
q_∞	dynamic pressure, $q_\infty = 1/2\ \rho_\infty V_\infty^2$
R	radius
r	distance from the origin
Re	Reynolds number
S	wing area
s	scale
t_1	elapsed time (seconds) measured from the start of the execution of the program
t_2	elapsed time (seconds) for the execution of the last case
V_∞	free stream velocity
W	dummy span defined as the independent variable in the interpolation routine used to calculate the lifting-surfaces span dimensions (see Section 7.4[6]).

X, Y, Z	coordinate axes of a right-handed Cartesian coordinate system.
$\overline{X}$, $\overline{Y}$, $\overline{Z}$	X-Y-Z coordinates that locate the 1/4 chord of the mean geometric chord (MGC) location in the general coordinate system.
α	wing angle of attack measured on the X-Z plane relative to the X-coordinate axis and the free stream velocity vector.
αR_o	wing angle of attack for zero lift ($C_L = 0$)
β	Prandtl-Glauert compressibility factor, $\beta = \sqrt{1 - M_\infty^2}$
Γ	circulation strength of a vortex filament
δ	increment of span
δ_f	deflection of flap
δ_{LA}	deflection of left aileron
δ_{RA}	deflection of right aileron
δ_{tab}	deflection of trim-tab
Δ	determinant
ΔL	increment in lift
ΔS	increment in area
ε	geometric twist (angle) of chord plane
Λ	sweepback angle
π	pi, $\pi = 3.14159$ (as used in the program)
ρ_∞	free stream density
ϕ	dihedral angle
$\vec{\psi}$	influence function coefficient
ψ	scalar part of the influence function coefficient
$1\vec{AB}$	unit vector defined by two field points A(X,Y,Z) and B(X,Y,Z).
$1\vec{N}$	unit vector normal to a surface
$1\vec{V}$	unit vector for the induced velocity

$\vec{1X}$, $\vec{1Y}$, $\vec{1Z}$ — unit vectors parallel to the X, Y, Z, coordinate axes respectively.

SUBSCRIPTS:

CG	center of gravity
CP	center of pressure
C/4	one-quarter chord point location
e	elemental panel or lifting-surface designation
f	flap
g	ground
h	hinge
I	image
i	induced
L	lower surface
LA	left aileron
LE	leading edge
M	moment
P	pitching
R	root (geometry) or rolling (moment)
RA	right aileron
ref	reference dimensions
tab	trim-tab
TE	trailing-edge
U	upper surface
v	vortex-lift
Y	yawing

LIST OF SYMBOLS (Continued)

SUPERSCRIPTS:

$\rightarrow$	vector
'	alternate

ABBREVIATIONS:

A.C.	aerodynamic center
C.G.	center of gravity
C.P.	center of pressure
L.E.	leading edge
MAC	mean aerodynamic chord
MGC	mean geometric chord
NCD	number of chord discontinuities
NCE	number of chord elements
NSE	number of span elements
T.E.	trailing edge

1.0 PROGRAM ABSTRACT

PROGRAM NUMBER:	HA010B (N.SURFACE)
PROGRAM TITLE:	TRW Vortex-Lattice Method Subsonic Aerodynamic Analysis for Multiple-Lifting-Surfaces
TAPE NUMBER:	T00078 or A10202
STATUS:	Production
LANGUAGE:	Fortran V
SYSTEM:	UNIVAC 1108/CDC 6500 Computer
CORE STORAGE REQUIREMENTS:	Approximately 50K words
TYPICAL EXECUTION TIME:	2 to 5 minutes per case (UNIVAC 1108)

DESCRIPTION:

The aerodynamic airload distribution and spatially-integrated force and moment coefficients are calculated for single- or multiple-lifting-surface configurations by an improved vortex-lattice method developed by TRW. In this method, the influence of each surface is represented by a network of concentrated line vortices distributed on the surfaces and behind the surface-trailing-edges. The strength or circulation of these vortices is determined by the requirement that the flow be parallel to each surface at a discrete number of boundary control points or co-location points that is equal to the number of unknown vortex strengths. The treatment of the control point boundary conditions incorporated in the analysis (TRW's) is based on the exact surface geometry, i.e., no linearization or other usual simplifying assumptions are made. This feature makes it possible to perform more accurate calculations for general non-planar lifting surface configurations. The effect of the leading-edge flow separation on the airload coefficients for theoretically sharp leading-edges is evaluated by an approximate technique based on the vortex-lift leading-edge suction analogy. Numerical solutions can be performed including as many as 200 separate vortex filaments or elemental surfaces for symmetric and 100 for unsymmetric aerodynamic loadings respectively. The extension of the imcompressible solutions to compressible flows ($0<M<1$) is accomplished via the Prandtl-Glauert transformation. Flight over a ground plane is calculated by the method of images as a special option of the program.

The output consists of data presented for ready engineering use such as pressure distributions, section coefficients, and spatially-integrated coefficients. Exact numerical solutions or arrays of solutions extrapolated using the lifting line theory from two or more exact vortex-lattice solutions may be output for multiple- and single-lifting-surfaces respectively. Other program features include: double precision matrix inversion, 4060-microfilm or Calcomp output, short or long print-format output, etc. An outline of the program analysis and execution options is presented in Pages 1-2 through 1-3.

PROGRAM ABSTRACT (Contd.)

ANALYTICAL MODEL FEATURES AND EXECUTION OPTIONS OUTLINE

ANALYSIS

- The aerodynamic airload distributions on single- or multiple-lifting surface configurations are calculated by an improved (TRW's) vortex-lattice method.
- The treatment of the control points is based on the exact geometry of the lifting surfaces, i.e., none of the usual linearization or other simplifying assumptions in the literature are incorporated in the analysis.
- The effect of leading-edge flow separation for theoretical-sharp leading edges (i.e., vortex-lift) is calculated by an approximate technique based on leading-edge suction analogy.
- Compressibility effects are accounted for via the Prandtl-Glauert transformation.
- Ground effects are calculated by the method of images that provides for exact analytical solutions for a flat ground plane of infinite extent, i.e., the boundary conditions of parallel flow at the ground plane are exactly satisfied.
- Arrays of solutions may be extrapolated from two exact vortex-lattice solutions by a method procedure based on the lifting-line theory.

VEHICLE CONFIGURATIONS

(See Table 1.01, Page 1-4)

- Single Surface: (XQT ISURF Option)
  A single surface of any configuration, shape, or form with or without severe surface discontinuities may be considered. This includes lifting surface configurations with flaps, ailerons, slots, with or without camber.
- Multiple Surfaces: (XQT NSURF Option)
  Up to five separate lifting surfaces of any configuration, shape, or form can be considered simultaneously. In each surface the effect of severe surface discontinuities can be considered in the same manner as outlined above for the single surface analysis. Multiple-lifting-surface configurations that may be analyzed include: wing-tail-fins, canard-wing-fins, thick-wing, lifting-body, and many other configurations. The complexity of the configurations that may be successfully analyzed depends on the maximum number of elemental panels or control points that can be considered simultaneously, i.e., 200 for symmetric and 100 for unsymmetric loadings respectively.

OUTPUT OPTIONS

- Printed Output
  1) Short-Print: the surface geometry, the airload force and pitching moment section coefficients, and all the force and moment spatially-integration airload coefficients are output for each of the lifting surfaces considered.
  2) Long-print: the short-print output, and the details of the lift (pressure coefficient) and vorticity distribution on each of the lifting surfaces considered are output.
  3) Debug-Print: the long-print output plus the details of the induced velocities and influence coefficients are output.
- Tape Output
  1) The lifting surface vortex-lattice geometry, section aerodynamic coefficients, etc. that are calculated in obtaining solutions are output on magnetic tape in the format required for executing the TRW plotting option, or
  2) By executing the plotting option (TRWPLT) included in the program, 4060-microfilm or Calcomp plots output of solutions (#1 above) can be obtained directly.

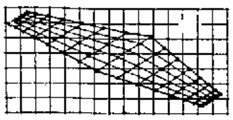
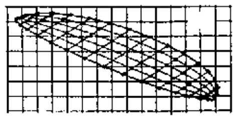
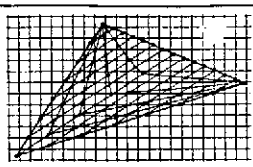
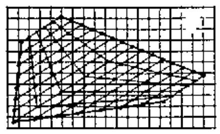
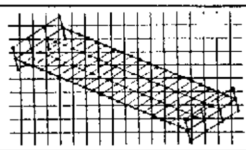
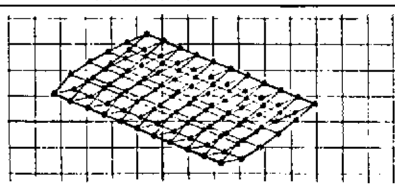
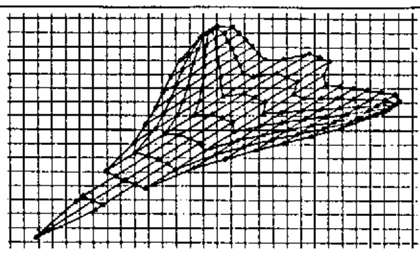
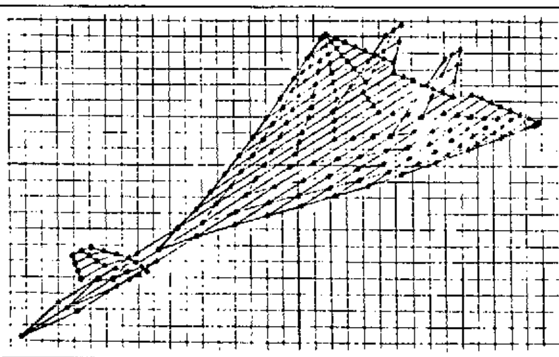
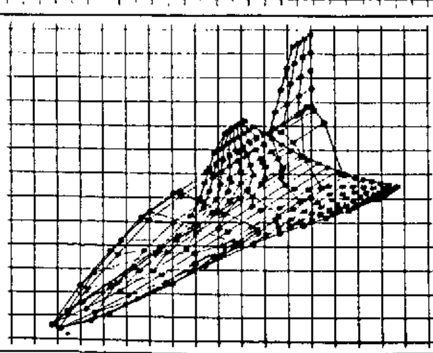
SPECIAL OPTIONS

- Ground effects: flight in the presence of a very near ground plane may be calculated.
- Lifting-Line: arrays of solutions may be obtained by extrapolation from two exact vortex-lattice solutions using a method based on the lifting-line theory. This option at present (HA010B) is available only for single-lifting-surface configurations.

EXECUTION TIME

- Symmetric loadings: about one minute per vortex-lattice solution for 100 elements.
- Unsymmetric loadings: about four minutes per vortex-lattice solution for 100 elements.
- With ground effects: about twice the time required for out-of-ground.
- Lifting-line arrays: about 1/2 minute extra running time.
- Maximum time: about four minutes and eight minutes per vortex-lattice solutions of out-of-ground and in-ground problems. The running times are based on 200 and 100 vortex-lattice elements for symmetric and unsymmetric loadings respectively.

TABLE 1.01 - REPRESENTATIVE LIFTING-SURFACE PROBLEMS OF VARIOUS CONFIGURATIONS THAT CAN BE SUCCESSFULLY SOLVED USING THE TRW VORTEX-LATTICE ANALYSIS PROGRAM NO. HA010B

VORTEX-LATTICE CONFIGURATION	NUMBER OF ELEMENTAL PANELS	EXECUTION TIME PER CASE	EVALUATION OF RESULTS
 	80	34 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF AR = 6 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
 	70	30 sec	TYPE: THIN-SURFACE PROBLEM: WINGS OF LOW AR RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	72	31 sec	TYPE: THIN-SURFACE PROBLEM: WING WITH END PLATES RESULTS: SATISFACTORY DIFFICULTY: SEVERE DISCONTINUITY
	100	42 sec	TYPE: THICK-SURFACE PROBLEM: WING THICKNESS RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	112	63 sec	TYPE: THIN-SURFACE PROBLEM: DOUGLAS F5D-1 AIRPLANE RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	162	98 sec	TYPE: THIN-SURFACE PROBLEM: NORTH AMERICAN XB-70 RESULTS: VERY SUCCESSFUL DIFFICULTY: NONE
	172	120 sec [vert. fin omitted]	TYPE: LIFTING-BODY PROBLEM: NASA-MSC #040A ORBITER RESULTS: NOT SUCCESSFUL DIFFICULTY: THE NUMBER OF ELEMENTAL PANELS THAT CAN BE CONSIDERED SIMULTANEOUSLY IS INSUFFICIENT TO PROVIDE VALID SOLUTIONS. BY NEGLECTING THE FUSELAGE THICKNESS THE THIN-SURFACE REPRESENTATION WAS APPLIED TO THIS PROBLEM VERY SUCCESSFULLY.

2.0 ANALYSIS

2.1 Analytical Procedures Review

It is a well know fact in aerodynamic theory that any surface, whether part of a body of finite thickness or merely an infinitesimally thin sheet, may be represented by a sheet of vorticity bound on the surface and a trailing vortex sheet shed behind the trailing edge. The velocity at any point in the flow field is the sum of the velocity vector induced by the vortex sheets and the free stream velocity vector. The strength of the vorticity representing the surface is determined by the requirement that the velocity vector computed as the sum of velocity induced by the vortex sheets and the free stream, be parallel to the surface. The strength of the trailing edge vortex sheet is determined from the surface bound vortex sheet strength using the conservation of vorticity laws for steady flow (i.e., Helmholtz vorticity laws) together with the requirement that there be no force exerted on the sheet, which means that the trailing edge vortex sheet must be everywhere parallel to the streamlines of the flow[(1,2,3)†].

In the vortex lattice method, the influence of the surface is represented by a network of concentrated line vortices, distributed on the surface and behind the trailing edge[(4,5)]. The strength of these vortices is determined by the requirement that the flow be parallel to the surface at a number of boundary point or co-location points which are equal to the number of unknown vortex strengths. The location of the trailing vortices must be assumed, and thus may not happen to be exactly parallel to the streamlines. However, the path of the vortex sheet behind the wing may be guessed beforehand with fairly good accuracy, and since, in most instances, the results are not strongly influenced by the assumed path of the trailing vortices, excellent results of high accuracy are usually obtained[(6)].

2.2 Vortex-Lattice Equations

The vortex lattice network arrangement used in the present analysis is illustrated in Figure 2.01[‡]. As shown in the figure, the wing surface is divided uniformly into a number of elemental panels of approximately equal size. The vorticity on the upper and lower surfaces of each panel is represented by a

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†Superscript in parathesis denote references listed in Section 8.

‡Figures and Tables of this section are found at the end of the section.

single bound vortex line which is located in accordance with 2-D theory at the 1/4 chord of the panel[7]. The location of the control point or co-location point is arbitrary and is usually selected at the mid point between adjacent vortex lines which corresponds to the 3/4 chord of the panel. Since the vortex filaments cannot be discontinuous, the bound vortices for each panel are bent at both ends forming a pair of trailing vortices which must extend to infinity. In this manner these vortices represent the vorticity in the trailing edge vortex sheet. The bound vortex at the 1/4 chord of the panels and the pair of trailing vortex filaments define a generalized skew-shaped (oblique) horseshoe vortex filament of strength Γ. The number of horseshoe vortex filaments is equal to the number of panels or control points. The velocity at the control points is by definition parallel to the surface, and hence, the corresponding normal velocity components to the surface are exactly equal to zero. This boundary condition when applied to the jth panel is given by

$$\left(\vec{1N}_j\right) \cdot \left(\frac{\vec{V}_\infty}{V_\infty} + \sum_{k=1}^{K} \frac{\Gamma_k/V_\infty}{4\pi} \vec{\psi}_{k(j)}\right) = 0 \qquad (2.2.01)$$

where:

$\vec{1N}_j$ = the unit vector normal to the surface at the jth control point,

$\vec{V}_\infty$ = the free stream velocity vector,

V_∞ = the scalar magnitude of the free stream velocity vector,

Γ_k = the strength of circulation of the kth panel horseshoe vortex filament,

$\vec{\psi}_{k(j)}$ = the induced velocity vector influence function of the kth panel horseshoe vortex evaluated at the jth control point,

K = the total number of panels for all the lifting surfaces considered.

The induced velocity vector and influence vector functions are calculated in accordance with the induced velocity law of Biot and Savart[2,3]. Using the geometry convention for a representative horseshoe vortex shown in Figure 2.02, it follows

$$\frac{\vec{V}_{i(j)}}{V_\infty} = \sum_{k=1}^{K} \frac{\Gamma_k/V_\infty}{4\pi} \vec{\psi}_{k(j)} \tag{2.2.02}$$

$$\vec{\psi}_{k(j)} = \oint \frac{\vec{d\ell} \times (\vec{r} - \vec{r}\,')}{|(\vec{r} - \vec{r}\,')|^3} \tag{2.2.03}$$

The calculation of the vector influence functions $\vec{\psi}(j)$ are somewhat tedious but straightforward. In the present analysis the trailing vortices are assumed to be straight lines which extend to infinity and which are oriented at an angle $\alpha/2$ in the manner shown in Figure 2.02. In this instance the bound vortex and trailing vortices for each panel form a generalized skew-shaped horseshoe vortex of the same configuration analysed in References 8 and 9. Analytical solutions for the vector influence functions are presented in Section 2.3. The number of unknown horseshoe filament circulation strengths Γ_k are equal to the number of boundary condition equations for the control points. Using matrix notation, these boundary conditions which were given in Equation 2.2.01, become

$$[A_j] + \left[\frac{\Gamma_k}{V_\infty}\right] \times [B_{j,k}] = 0 \tag{2.2.04}$$

By inverting the matrix $[B_{j,k}]$, the unknown circulation strengths Γ_k are obtained

$$\left[\frac{\Gamma_k}{V_\infty}\right] = -[A_j] \times \left\{[B_{j,k}]\right\}^{-1} \tag{2.2.05}$$

In the presence of a ground plane, exact analytical solutions are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirement for the flow at the ground plane is exactly satisfied by defining a mirror image of the vortex lattice directly below at a distance equal to twice the altitude from the ground plane. The calculation of the induced velocity (Equation 2.2.02) is modified to include the effect of the image vortex lattice influence coefficients as follows

$$\frac{\vec{V}_{i(j)}}{V_\infty} = \sum_{k=1}^{K} \frac{\Gamma_k/V_\infty}{4\pi} \left[\vec{\psi}_{k(j)} - \vec{\psi}^{\,I}_{k(j)} \right] \tag{2.2.06}$$

$\vec{\psi}^{\,I}_{k(j)}$ = the influence function of the image vortex lattice.

Note that in the present formulation, none of the usual linearization or other simplifying assumptions were made on the boundary conditions at the control points (e.g., References 10 and 11). Therefore, severe variations in lifting surfaces planform such as twist, camber, dihedral, etc. are treated exactly and more accurate solutions may be obtained.

2.3 Influence Coefficients

Consider the straight vortex-filament element of length ΔS that is illustrated in Figure 2.03. In computing the induced velocity vector for the vortex filament at a field point P(O,Y,Z), the influence coefficient is obtained by integrating Equation 2.2.03 within the appropriate boundary conditions described in the figure. It follows

$$\overrightarrow{\Delta V} = \frac{\Gamma}{4\pi} \overrightarrow{\Delta \psi} \qquad \text{(the induced velocity)} \tag{2.3.01}$$

$$\overrightarrow{\Delta \psi} = \overrightarrow{1V} \, \Delta \psi \qquad \text{(the influence coefficient)} \tag{2.3.02}$$

where $\overrightarrow{1V}$ and $\Delta\psi$ are a unit vector and a scalar quantity, respectively. These are given by

$$\overrightarrow{1V} = - \overrightarrow{1AQ} \times \overrightarrow{1QP} = - \frac{Z}{R} \overrightarrow{1Y} + \frac{Y}{R} \overrightarrow{1Z} \tag{2.3.03}$$

$$\Delta \psi = \frac{1}{R} \left[\frac{h + \Delta S}{\sqrt{(h + \Delta S)^2 + R^2}} - \frac{h}{\sqrt{h^2 + R^2}} \right] \tag{2.3.04}$$

$$R = \sqrt{Y^2 + Z^2} \tag{2.3.05}$$

The above equations can be used to determine the influence coefficient vector for any field point P(X,Y,Z) of any complex-shaped filament if it is assumed that it is composed of a discrete number of rectilinear increments ΔL (illustrated in Figure 2.03) and by performing the appropriate coordinate transformations. For the generalized skew-shaped vortex filament in Figure 2.02,

the calculation of the influence coefficient vector for any flow field P(X,Y,Z) is performed in this manner. Making use of the localized coordinate system in Figure 2.04, the shape of the skew-shaped vortex filament is prescribed by the coordinates of points B-D given by

$$B = B(-c, -a, -d) \tag{2.3.06}$$

$$D = D(c, a, d) \tag{2.3.07}$$

$$c = a \tan(\Lambda) \tag{2.3.08}$$

$$d = a \tan(\phi) \tag{2.3.09}$$

If the vortex filament is broken into three elements, i.e., ∞-A-B, D-E-∞, and B-C-D, the influence coefficient vector for the filament is equal to the sum

$$\vec{\psi} = \sum_{i=1}^{3} \vec{1V}_i \, \Delta\psi_i \tag{2.3.10}$$

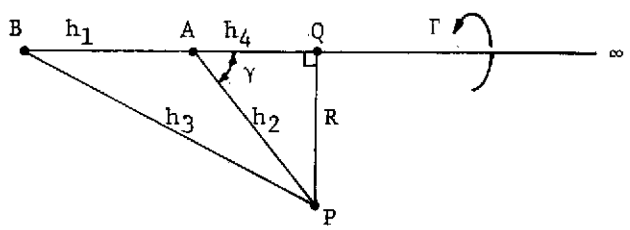
Segment #1 (∞-A-B)

The contribution of segment #1 for an arbitrary field point P(X,Y,Z) is calculated as follows. The coordinates of point A are given by

$$A = A(X, -a, -d') \tag{2.3.11}$$

$$d' = d + (X + c) \tan(\alpha/2) \tag{2.3.12}$$

and making use of the geometry according to the sketch below,



$$h_1 = \sqrt{(X + c)^2 + (d' - d)^2} \tag{2.3.13a}$$

$$h_2 = \sqrt{(Y + a)^2 + (Z + d)^2} \tag{2.3.13b}$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \tag{2.3.13c}$$

$$\cos(\gamma) = -\frac{h_1{}^2 + h_2{}^2 - h_3{}^2}{2h_1 h_2} \tag{2.3.13d}$$

$$R = h_2 \sqrt{1 - (\cos \gamma)^2} \tag{2.3.13e}$$

$$h_4 = h_2 \cos(\gamma) \tag{2.3.13f}$$

Using Equation 2.3.04, the scalar part of the influence coefficient can now be computed

$$\Delta\psi_1 = \frac{1}{R}\left[1 + \frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}}\right] \tag{2.3.14}$$

The calculation of the vector part of the influence coefficient will be considered next. The coordinates of point Q shown on the sketch are

$$Q = Q(X_q, Y_q, Z_q) \tag{2.3.15a}$$

$$X_q = -c + (h_1 + h_4)\cos(\alpha/2) \tag{2.3.15b}$$

$$Y_q = -a \tag{2.3.15c}$$

$$Z_q = -d - (h_1 + h_4)\sin(\alpha/2) \tag{2.3.15d}$$

and the unit vectors for the line segments B-Q and Q-P can now be calculated

$$\overrightarrow{1BQ} = \overrightarrow{1X}\cos(\alpha/2) - \overrightarrow{1Z}\sin(\alpha/2) \tag{2.3.16}$$

$$\overrightarrow{1QP} = \overrightarrow{1X}\left(\frac{X - X_q}{R}\right) + \overrightarrow{1Y}\left(\frac{Y - Y_q}{R}\right) + \overrightarrow{1Z}\left(\frac{Z - Z_q}{R}\right) \tag{2.3.17}$$

then, the vector part of the influence coefficient, i.e., a unit vector, is given by the vector cross-product

$$\overrightarrow{1V_1} = \overrightarrow{1BQ} \times \overrightarrow{1QP} \qquad (2.3.18)$$

Segment #2 (D-E-∞)

The contribution of segment #2 for the same arbitrary field point P(X,Y,Z) is calculated in the same manner as outlined for segment #1; specifically, Equations 2.3.19 through 2.3.23 are used in place of 2.3.11, 2.3.12, 2.3.13, and 2.3.15 respectively, where

$$E = E\ (X,\ a,\ +d') \qquad (2.3.19)$$

$$d' = d - (X - c)\tan(\alpha/2) \qquad (2.3.20)$$

$$h_1 = \sqrt{(X - c)^2 + (d - d')^2} \qquad (2.3.21a)$$

$$h_2 = \sqrt{(Y - a)^2 + (Z - d)^2} \qquad (2.3.21b)$$

$$h_3 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \qquad (2.3.21c)$$

$$X_q = c + (h_1 + h_4)\cos(\alpha/2) \qquad (2.3.22a)$$

$$Y_q = a \qquad (2.3.22b)$$

$$Z_q = d - (h_1 + h_4)\sin(\alpha/2) \qquad (2.3.22c)$$

$$\overrightarrow{1V_2} = -\ \overrightarrow{1DQ} \times \overrightarrow{1QP} \qquad (2.3.23a)$$

$$\overrightarrow{1DQ} = \overrightarrow{1BQ} \qquad (2.3.23b)$$

Segment #3 (B-C-D)

The contribution of segment #3 for the same arbitrary field point P(X,Y,Z) considered for segments #1 and #2 is calculated in a like manner as outlined in detail for segment #1. For segment #3, the coordinates of points B(-c,-a,-d) and D(c,a,d) are used to determine the solutions for

$$h_1 = 2\sqrt{c^2 + a^2 + d^2} \tag{2.3.24a}$$

$$h_2 = \sqrt{(X - c)^2 + (Y - a)^2 + (Z - d)^2} \tag{2.3.24b}$$

$$h_3 = \sqrt{(X + c)^2 + (Y + a)^2 + (Z + d)^2} \tag{2.3.24c}$$

$$\cos(\gamma) = -\frac{h_1^2 + h_2^2 - h_3^2}{2h_1 h_2} \tag{2.3.24d}$$

$$h_4 = h_2 \cos(\gamma) \tag{2.3.24e}$$

$$R = h_2\sqrt{1 - (\cos\gamma)^2} \tag{2.3.24f}$$

and using Equation 2.3.04, the scalar part of the influence coefficient for segment #3 (B-D) can now be computed

$$\Delta\Psi_3 = \frac{1}{R}\left[\frac{h_1 + h_4}{\sqrt{(h_1 + h_4)^2 + R^2}} - \frac{h_4}{\sqrt{h_4^2 + R^2}}\right] \tag{2.3.25}$$

Next, to calculate the vector part of the influence coefficient the coordinates of point $Q(X_q, Y_q, Z_q)$ must be calculated first. Accordingly

$$X_q = c + h_4\ (2c/h_1) \tag{2.3.26a}$$

$$Y_q = a + h_4\ (2a/h_1) \tag{2.3.26b}$$

$$Z_q = d + h_4 \ (2d/h_1) \tag{2.3.26c}$$

The unit vectors $\overrightarrow{1BQ}$ and $\overrightarrow{1QP}$ are given by

$$\overrightarrow{1BQ} = \vec{1X}\left(\frac{2c}{h_1}\right) + \vec{1Y}\left(\frac{2a}{h_1}\right) + \vec{1Z}\left(\frac{2d}{h_1}\right) \tag{2.3.27}$$

$$\overrightarrow{1QP} = \vec{1X}\left(\frac{X - X_q}{R}\right) + \vec{1Y}\left(\frac{Y - Y_q}{R}\right) + \vec{1Z}\left(\frac{Z - Z_q}{R}\right) \tag{2.3.28}$$

from which the vector part of the influence coefficient, i.e., the unit vector $\vec{1V}_3$, can be calculated by simply taking the vector cross-product

$$\vec{1V}_3 = - \overrightarrow{1BQ} \times \overrightarrow{1QP} \tag{2.3.29}$$

2.4 Exact-Theory Aerodynamic Forces and Moments

The net aerodynamic force vector exerted on the jth panel (i.e., jth elemental surface) is calculated using

$$\frac{\vec{F}_j}{\rho_\infty V_\infty^{\ 2}} = \frac{\left(\dfrac{\vec{V}_j}{V_\infty} \times \vec{\Delta L}_j\right)\dfrac{\Gamma_j}{V_\infty}}{\beta} \tag{2.4.01}$$

$$\frac{\vec{V}_j}{V_\infty} = \frac{\vec{V}_\infty}{V_\infty} + \sum_{k=1}^{K} \frac{\Gamma_k/V_\infty}{4\pi} \ \vec{\psi}_{k(j)} \tag{2.4.02}$$

where

$\vec{\Delta L}_j$ = the length vector of the bound vortex filament of the panel,

$\vec{V}_j$ = the velocity vector computed as the sum of free stream and induced velocity vectors evaluated at the midpoint of the bound vortex of the jth panel,

β = the Prandtl-Glauert compressibility factor, = $\sqrt{1 - M_\infty^{\ 2}}$

C

$\vec{\psi}_{k(j)}$ = the vector influence function of the kth panel evaluated at midpoint of the jth bound vortex.

The force vector $\vec{F}_j$ is assumed to act at the midpoint of the bound vortex filament of the kth panel. The corresponding section aerodynamic load coefficients and integrated wing force and moment coefficients are obtained by the appropriate summation of the forces $\vec{F}_j$ acting on each panel. In determining these quantities the following relations derived from the exact analysis are used

Force Coefficients for jth Panel

$$c_{F_{X,j}} = 2 \left(\frac{\vec{F}_j/(\rho_\infty V_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1X}) \tag{2.4.03}$$

$$c_{F_{Y,j}} = 2 \left(\frac{\vec{F}_j/(\rho_\infty V_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Y}) \tag{2.4.04}$$

$$c_{F_{Z,j}} = 2 \left(\frac{\vec{F}_j/(\rho_\infty V_\infty^2)}{\Delta S_j} \right) \cdot (\vec{1Z}) \tag{2.4.05}$$

Differential Pressure Coefficients

$$\left(c_{P_L} - c_{P_U} \right)_j = 2 \left| \left(\frac{\vec{F}_j/(\rho_\infty V_\infty^2)}{\Delta S_j} \right) \right| \tag{2.4.06}$$

Lifting Surface Section Airload Coefficients

For each lifting surface, by summing up the appropriate force contributions,

$$c_{n(Y)} = - \frac{1}{C} \sum c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \Bigg|_Y \tag{2.4.07}$$

$$c_{t(Y)} = - \frac{1}{C} \sum c_{F_{X,j}} \frac{\Delta S_j}{\Delta Y_j} \Bigg|_Y \tag{2.4.08}$$

$$c_{m(Y)} = \frac{1}{C^2} \sum \left[c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \left(X_j - X_{(C/4)} \right) + c_{F_{X,j}} \frac{\Delta S_j}{\Delta Y_j} \left(Z_j - Z_{(C/4)} \right) \right]_Y \tag{2.4.09}$$

$$c_{\ell(Y)} = c_{n(Y)} \cos(\alpha) + c_{t(Y)} \sin(\alpha) \qquad (2.4.10)$$

$$c_{d_{i(Y)}} = - c_{t(Y)} \cos(\alpha) + c_{n(Y)} \sin(\alpha) \qquad (2.4.11)$$

<u>Lifting Surface Spatially-Integrated Airload Coefficients</u>

$$C_N = - \frac{1}{S} \sum_j c_{F_{Z,j}} \Delta S_j \qquad (2.4.12)$$

$$C_T = - \frac{1}{S} \sum_j c_{F_{X,j}} \Delta S_j \qquad (2.4.13)$$

$$C_{M_{P(\bar{C}/4)}} = \frac{1}{S\,\bar{C}} \sum_j \Delta S_j \left(c_{F_{Z,j}} X_{a_j} - c_{F_{X,j}} Z_{a_j} \right) \qquad (2.4.14)$$

$$C_{M_{R(\bar{C}/4)}} = \frac{1}{S\,\bar{C}} \sum_j \Delta S_j \left(c_{F_{Y,j}} Z_{a_j} - c_{F_{Z,j}} Y_{a_j} \right) \qquad (2.4.15)$$

$$C_{M_{Y(\bar{C}/4)}} = \frac{1}{S\,\bar{C}} \sum_j \Delta S_j \left(c_{F_{Y,j}} X_{a_j} - c_{F_{X,j}} Y_{a_j} \right) \qquad (2.4.16)$$

$$C_L = C_N \cos(\alpha) + C_T \sin(\alpha) \qquad (2.4.17)$$

$$C_{D_i} = - C_T \cos(\alpha) + C_N \sin(\alpha) \qquad (2.4.18)$$

$$X_{a_j} = X_j - X_{(\bar{C}/4)} \qquad (2.4.19)$$

$$Y_{a_j} = Y_j \qquad (2.4.20)$$

$$Z_{a_j} = Z_j - Z_{(\bar{C}/4)} \qquad (2.4.21)$$

In equations 2.4.07 through 2.4.16 the summations are performed over the vortex-lattice elemental surfaces that correspond to each lifting surface. To obtain the total force for the sum of N lifting surfaces, the summation is carried out over all the panels (j=1,J) and the reference dimensions for the first lifting surface (n=1) are used.

2.5 Approximate-Theory Aerodynamic Forces and Moments

In the preceding sections the procedure for obtaining exact solutions for the aerodynamic forces and moments by the vortex lattice method were developed. To generate an array of such solutions (for instance by varying the wing angle of attack) would be considered unwise because of the excessive computing time expenditure required. Instead, an array of approximate solutions of sufficient engineering accuracy may be obtained by extrapolation from two exact vortex lattice solutions by using the lifting line theory. Accordingly, for a single lifting surface, given two exact solutions obtained at two different angles of attack α_1, and α_2, the extrapolated solutions for any other angle of attack α may be obtained in the following manner.

Wing Lift Coefficient

$$\bar{m} = \frac{C_{L_1} - C_{L_2}}{\alpha_1 - \alpha_2} \tag{2.5.01}$$

$$\alpha R_o = \alpha_1 - \frac{C_{L_1}}{\bar{m}} \tag{2.5.02}$$

$$C_L = \bar{m}\,(\alpha - \alpha R_o) \tag{2.5.03}$$

Wing Moment Coefficients (Pitching, Rolling, and Yawing) about $\bar{C}/4$

$$C_M' = \frac{C_{M_1} - C_{M_2}}{C_{L_1} - C_{L_2}} \tag{2.5.04}$$

$$C_{M_o} = C_{M_1} - C_M' \; C_{L_1} \tag{2.5.05}$$

$$C_M = C_{M_o} + C_M' \; C_L \tag{2.5.06}$$

Wing Section Lift Coefficients

$$c\ell a_{1(Y)} = \frac{c\ell_{1(Y)} - c\ell_{2(Y)}}{C_{L_1} - C_{L_2}} \tag{2.5.07}$$

$$c\ell b_{(Y)} = c\ell_{1(Y)} - c\ell a_{1(Y)} \, C_{L_1} \tag{2.5.08}$$

$$c\ell_{(Y)} = c\ell a_{1(Y)} \, C_L + c\ell b_{(Y)} \tag{2.5.09}$$

Wing Section Induced Drag Coefficients

$$cd'_{i(Y)} = \left(\frac{cd_{i_1} - cd_{i_2}}{c\ell_1^{\,2} - c\ell_2^{\,2}} \right)_{(Y)} \tag{2.5.10}$$

$$cd_{i_{o(Y)}} = cd_{i_{1(Y)}} - cd'_{i(Y)} \, c\ell_{1(Y)}^{\;2} \tag{2.5.11}$$

$$cd_{i(Y)} = cd_{i_o} + cd'_{i(Y)} \, c\ell_{(Y)}^{\;2} \tag{2.5.12}$$

or using the lifting line theory exact results,

$$cd_{i(Y)} = \left[\frac{1}{\pi \, c\ell a_{1(Y)}} - \frac{1}{2\pi} \right] c\ell_{(Y)}^{\;2} \tag{2.5.13}$$

Equation 2.5.13 is recommended in the analysis of wing planforms of moderate aspect ratio and negligible sweep and dihedral angles.

Wing Induced Drag Coefficient

$$C_{D_i} = \frac{1}{S} \int_{-b/2}^{+b/2} cd_{i(Y)} \; c_{(Y)} \; dY \tag{2.5.14}$$

which when expressed as a function of C_L becomes

$$C_{D_i} = C_{D_{i_o}} + C_{D'_{i_1}} \, C_L + C_{D'_{i_2}} \, C_L^{\,2} \tag{2.5.15}$$

The coefficients $C_{D_{i_o}}$, $C_{D_{i_1}}$ and $C_{D_{i_2}}$ are constants which may be evaluated from three separate approximate solutions.

Drag Due to Skin Friction

$$cd_f = 2\ CF \quad (\text{CONSTANT}) \tag{2.5.16}$$

$$C_{D_f} = cd_f \tag{2.5.17}$$

where CF is the aerodynamic cleanness factor which is defined as

$$CF = \frac{\text{EQUIVALENT FLAT PLATE AREA}}{\text{WETTED AREA}} = \frac{C_{D_\pi} S_\pi}{2S} \tag{2.5.18}$$

The total drag coefficients are obtained as the sum of induced drag and skin friction drag for the wing section coefficients and the integrated wing coefficients respectively.

2.6 Vortex Lift

Experimental studies of sharp leading edge delta wings have shown that at even relatively low angles of attack the flow separates from the leading edge and rolls up into two vortex sheets or cone shaped cores of rotating fluid particles with the axes of rotation located approximately parallel to the leading edges[12,13]. In general, this vortex flow results in an increase in lift that is called vortex lift or non-linear lift, and an increase in drag resulting from the loss of leading edge suction. Although it is desirable to avoid the formation of the separated flow vortex sheets because of the high drag, it is a phenomenon which is always encountered by low aspect ratio highly swept wings operating near the stalling attitude. Furthermore, the separated vortex flow phenomenon is not restricted to this type of wing planform but is a general characteristic of all sharp leading-edge wings regardless of their leading-edge sweep angle.

The attached flow and separated vortex flow over blunt and sharp leading edge wings respectively are schematically illustrated in Figure 2.05. For the attached flow (blunt leading edges) there exists a net thrust force which is called the leading edge suction. This force may be interpreted to be

exerted by the bound vortex filaments at the leading edge. For sharp leading edges, attached flow cannot exist because of the infinitely large velocity and low pressure required, and therefore, the flow separates locally displacing the leading edge bound vortex filaments into the cavity formed by the separated flow. The vortex filaments in the cavity are not free vortices and therefore they will exert a net force in the normal direction to the wing surface because of the reorientation of the velocity vector.

Exact analytical solutions for sharp leading edge wings with leading edge separated flow are available in the published literature for a very restrictive range of wing geometries[14,15,16]. Usually these solutions are based on the assumption of conical flow, and as a consequence, only perfect delta wing planforms which feature no twist, no camber, and straight trailing edges can be considered. Therefore, in the prediction of the vortex lift for arbitrary sharp leading edge wing planforms, only empirical methods or approximate theory is available. The most successful analytical techniques are based on the vortex-lift leading-edge suction analogy. The method is based on the assumption that the vortex lift vector can be estimated from the leading edge thrust or suction force associated with the flow over the wing planform without separated flow at the leading edge. It follows (see Figure 2.05)

$$\Delta c_{n_v} = \frac{c_t}{\cos(\Delta_{LE})} \left(\frac{\alpha}{|\alpha|}\right) \tag{2.6.01}$$

$$\Delta c_{t_v} = - c_t \tag{2.6.02}$$

$$\Delta c_{m_{v(c/4)}} = - \Delta c_{n_v} \left(\frac{X_{LE} - X_{(C/4)}}{C}\right) \tag{2.6.03}$$

$$\Delta c\ell_v = \Delta c_{n_v} \cos(\alpha) + \Delta c_{t_v} \sin(\alpha) \tag{2.6.04}$$

$$\Delta cd_v = - \Delta c_{t_v} \cos(\alpha) + \Delta c_{n_v} \sin(\alpha) \tag{2.6.05}$$

These increments represent the force and moment coefficients due to the vortex lift which must be added to each lifting surface section coefficients in order t

obtain the net forces on the wing corresponding to the case of no leading edge suction. In the derivation of these relations, the vortex lift distribution has been assumed to act at the leading edge and normal to the wing chord plane.

Because of the approximate manner in which the leading edge suction thrust coefficient is calculated the evaluation for the vortex lift effects are only applicable to lifting surface planforms having a flat chord plane. Note that the thrust coefficient is calculated by integration of the forces in chordwise strips acting in all the bound vortices of the vortex-lattice matrix. Such an integration will provide accurate evaluations of the leading edge thrust if the chord plane is flat or if a very large number of chordwise rows are considered. If an infinite number of chordwise rows are considered, the vortex-lattice method will provide solutions equivalent to the potential flow solutions and an exact evaluation of the leading edge suction force will result. In the latter case, the leading edge suction thrust coefficient could be evaluated from the force exerted by a few of the leading edge bound vortices.

The spatially integrated wing coefficient increments due to the leading edge vortex lift are calculated from the wing section coefficient span distributions given in Equations 2.6.01 through 2.6.05, as follows

$$\Delta C_{L_v} = \frac{1}{S}\int_{-b/2}^{+b/2} \Delta c\ell_v \; C \; dY \tag{2.6.06}$$

$$\Delta C_{D_v} = \frac{1}{S}\int_{-b/2}^{+b/2} \Delta cd_v \; C \; dY \tag{2.6.07}$$

$$\Delta C_{M_{P,v}(\bar{C}/4)} = \frac{1}{S\,\bar{C}}\int_{-b/2}^{+b/2}\left[-\;\Delta c_{n_v}\left(X_{LE} - X_{(\bar{C}/4)}\right) + \Delta c_{t_v}\left(Z_{LE} - Z_{(\bar{C}/4)}\right)\right] C\; dY \tag{2.6.08}$$

For obtaining approximate solutions of the vortex lift at selected wing angles of attack from two or more exact vortex lattice solutions, the following assumption is made which yields accurate results

$$\Delta c_{n_v}(Y,\alpha) = C_{1(Y)} + C_{2(Y)} \frac{\alpha^3}{|\alpha|} \tag{2.6.09}$$

$$\Delta c_{t_v}(Y,\alpha) = C_{3(Y)} + C_{4(Y)} \alpha^2 \tag{2.6.10}$$

The quantities C_1, C_2, C_3, and C_4 are constants which are evaluated from the two vortex lattice solutions obtained at different angles of attack α_1 and α_2 in the manner described in Section 2.5.

2.7 Surface Discontinuities

Surface discontinuities occurring in the wing surface such as those encountered at the aileron-flap juncture cannot be treated exactly by the vortex lattice solution technique. Although by increasing the number of elements or control points the accuracy of the solutions should in principle be improved, sharp discontinuities in the surface may cause local oscillations on the solutions that become more severe as the number of elements are increased. To circumvent this problem, a cosine smoothing option whose effect is illustrated in Figure 2.06 has been adopted. The affected span length δ is prescribed by the program user as an execution input. A value of 1/5 of the semispan is recommended. In addition, various other options for spacing the elements in the spanwise and chordwise directions have been made available. These include constant spacing, cosine spacing, and spacing prescribed as an execution input. For deflected control surfaces, a minimum of four elements of approximate equal size per chordwise row is recommended, the last element corresponding to the deflected surface.

The airload section coefficients for the flapped surfaces are calculated in a similar manner to the wing section coefficients (Section 2.4). By considering only the forces on the bound vortices on the flapped surfaces $(X_j - X_{h,j})$ it follows

$$c_{n_f}(Y) = -\frac{1}{C_f} \sum c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \Bigg|_{Y,\ (X_j - X_{h,j})} \tag{2.7.01}$$

$$c_{t_f}(Y) = -\frac{1}{C_f} \sum c_{F_{X,j}} \frac{\Delta S_j}{\Delta Y_j} \Bigg|_{Y,\ (X_j - X_{h,j})} \tag{2.7.02}$$

$$c_{h_f}(Y) = \frac{1}{C_f^2} \sum \left[c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \left(X_j - X_{h,j} \right) + c_{F_{Z,j}} \frac{\Delta S_j}{\Delta Y_j} \left(Z_j - Z_{h,j} \right) \right]_{Y,\ (X_j - X_{h,j})} \qquad (2.7.03)$$

$$c_{\ell_f}(Y) = c_{n_f}(Y) \cos(\alpha) + c_{t_f}(Y) \sin(\alpha) \qquad (2.7.04)$$

$$c_{d_{i,f}}(Y) = - c_{t_f}(Y) \cos(\alpha) + c_{n_f}(Y) \sin(\alpha) \qquad (2.7.05)$$

For obtaining approximate solutions (see Section 2.5) the following assumptions are made

$$c_{\ell_f}(Y,\alpha) = F_{1(Y)} + F_{2(Y)}\ \alpha \qquad (2.7.06)$$

$$c_{d_{i,f}}(Y,\alpha) = F_{3(Y)} + F_{4(Y)} \left(c_{\ell_f}(Y,\alpha) \right)^2 \qquad (2.7.07)$$

$$c_{h_f}(Y,\alpha) = F_{5(Y)} + F_{6(Y)}\ \alpha^2 \qquad (2.7.08)$$

The quantities F_1, F_2, .. F_6 are constants which are evaluated from two exact vortex lattice solutions obtained at different angles of attack α_1 and α_2.

2.8 Lift in the Presence of a Fuselage

Two options for calculating the lift in the presence of a generalized cylindrical-shaped fuselage are possible:

1) Analytical Method - Circular Shaped Fuselage

In this method the effect of a circular shaped fuselage of radius R and of infinite length is analyzed by the method of images. According to the hydrodynamic theory, the boundary conditions of zero normal flow to the fuselage surface due to wing trailing vortices are satisfied by defining a pair of vortex filament images inside the fuselage. Since the free stream velocity vector is neglected in satisfying the boundary conditions on the fuselage, only approximate solutions which are valid at small angles of attack are obtainable (i.e., the fuselage attitude is oriented parallel to the wing trailing vortices). Using cylindrical coordinates with the axis of symmetry located at the center of the fuselage, the location of the pair of images

for a wing trailing vortex filament is determined from

Image # 1 | Image # 2 †

$$X_I = X \qquad\qquad X_I = X \tag{63}$$

$$\vec{r}_I = \vec{r}\left(\frac{R}{|\vec{r}|}\right)^2 \qquad\qquad \vec{r}_I = 0 \tag{64}$$

$$\Gamma_I = -\Gamma \qquad\qquad \Gamma_I = \Gamma \tag{65}$$

where $\left.\begin{array}{l} X \\ r \\ \Gamma \end{array}\right\}$ the coordinates and circulation strength at a point in a wing trailing vortex filament.

The calculation of the induced velocity of the pair of images is performed by integration in the manner outlined in Section 2.3 from which the calculation of the induced velocity vector influence functions follows.

The effect of the presence of a circular shaped fuselage on the wing bound vortices cannot be determined by exact analysis except under very restrictive assumptions for the wing geometry. Therefore, a relatively simple and approximate approach has to be adopted. The effect of the presence of the fuselage on the velocity induced by the bound vortices is assumed to be the same as its effect on a two-dimensional uniform rectilinear flow. Thus, the velocity component induced by the bound vortices at some point P in the flow field is increased by a factor

$$\left[1 + \left(\frac{R}{|\vec{r}_{(P)}|}\right)^2\right] \tag{2.8.04}$$

which is an exact correction for a straight and infinite bound vortex line intersecting the cylinder axis of symmetry at 90°. The approximation will be valid for wings having small sweepback angles and slender fuselages centered at the wing axis of symmetry.

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†The sum of the contribution of images #2 will be zero for symmetric wing loadings.

2) Vortex-Lattice Method - Arbitrary Shaped Fuselage

The effect of the presence of an arbitrary shaped fuselage on the wing lift can be calculated using the vortex lattice method.† The accuracy of the solutions that are obtained depends on the selection of the number of control points and their location on the fuselage surface. For accurate calculation of the fuselage it would probably require an equal or larger number of control points on the fuselage surface than the number used for the wing. The main advantages of using the vortex-lattice method in preference to other analytical methods (e.g., the method of images) are: (1) non-planar wings of arbitrary planform may be analyzed, (2) no restriction is placed on the cross section, length or shape of the fuselage, and (3) the accuracy desired for obtaining solutions can be obtained by increasing the number of panels or by varying the location of the control points at the surface of the fuselage. In the present vortex-lattice program (HA010B), the treatment of exact fuselage-wing vehicle configurations is severely limited by the total number of elemental vortex-filament surfaces (about 100) that can be considered simultaneously. At present, only by an approximate representation of the fuselage (e.g., by defining an equivalent flat surface) can the fuselage-wing configurations be analyzed by the program.

2.9 Program Qualification Tests

The vortex lattice method is suitable for determining accurate solutions for the aerodynamic loads on lifting surfaces of arbitrary planforms. Nevertheless, for conventional wing planforms featuring negligible dihedral and small camber, generally more exact analytical solution methods based on the integral lifting surface[7] and lifting line theories[16] are available. These solutions and equivalent experimental test results have been used to demonstrate the accuracy of the present vortex-lattice analytical method.[8] For wing planforms with severe surface discontinuities, only comparisons

†It is a well known fact in hydrodynamic theory that the presence of arbitrary bodies immersed in a steady subsonic or supersonic flow field can be represented by distributions of sources and sinks inside the volume occupied by the bodies. Mathematically, the distributions of sources and sinks may be replaced by distributions of doublets or vortex filaments located on the surface of the bodies. If the vortex filament representation is adopted (i.e., the vortex lattice method), a rectangular vortex ring for each panel in the surface of the bodies is defined with the corresponding control points located at the center of each panel.

against available experimental test results can be performed. In general it should be noted that: (1) the vortex lattice solutions are affected by the number of surface elements, the location of the control points, and the geometric arrangement of the vortex lattice network which are input quantities prescribed by the program users, (2) for conventional wing planforms with moderate aspect ratio and moderate dihedral and sweepback angles, the lifting line methods will provide more accurate solutions, and (3) when the wing surface is placed very near a ground plane, large differences in the span and chord lift distributions in comparison with out-of-ground conditions occur; therefore, ground effects can only be properly analyzed by the integral lifting surface or the vortex lattice method. In the lifting line method the local section aerodynamic characteristics are assumed to depend only on the airfoil section properties for two dimensional flow (i.e., infinite aspect ratio) which are generally determined from wind tunnel tests.[17, 18] In the presence of a very near ground plane this assumption is not valid.

2.9.1 Vortex-Lattice Geometry and Control Point Locations

The effect of varying the vortex lattice geometric arrangement for a fixed wing planform on the solution of the spatially integrated wing airload coefficients is demonstrated in Table 2.01. Predictions are presented for a delta wing planform of aspect ratio of two. Both constant spacing and cosine spacing of the elements in the spanwise and chordwise directions are considered. Nevertheless, the differences between solutions on the integrated wing coefficients is found to be negligible, i.e., within one percent. On the other hand, the variation of the vortex lattice arrangement due to constant and variable (cosine) spacing of the elements shows a significant effect on the predictions for the spanwise section lift distribution in the region near the wing tip (see Figure 2.07). Based on the results presented, it is concluded that constant span spacing of the elements provides more reasonable solutions than variable spacing for wings of low aspect ratio (~ 2). For moderate to high aspect ratio wings, the opposite is found to be true. As a general rule, accurate solutions are obtained by selecting not less than ten spanwise elements and not less than four chordwise elements. The spacing of the elements should be such that adjacent elements have approximately equal size and equal configuration. Furthermore, the accuracy of the predicted spatially integrated wing coefficients depends primarily on the total number

of elements considered, i.e., errors in the calculated local airload coefficients will cancel out in the integration process.

The effect of varying the control point locations on the wing integrated airload coefficients for a delta wing of aspect ratio of two is presented in Table 2.02. As shown in the table, by moving the control points aft of the 3/4 chord of the panels, an increase in the wing airloads and a forward shift of the center of pressure results. Similar conclusions are drawn for wings of moderate aspect ratio and negligible sweepback angles (see Table 2.03). Although for the low aspect ratio delta wing planforms better agreement between analytical and experimental solutions are obtained with the control point locations aft of the 3/4 chord of the panels, the best control point location which provides accurate results for any wing planform is considered to be at the 77 percent of the elemental chords.(7, 19)

2.9.2 Wings of Moderate Aspect Ratio and Negligible Sweepback

Three different basic wing planforms of aspect ratio of six having no twist and zero sweepback at the 1/4 chord are considered. Solutions for the integrated wing airload coefficients using the present vortex lattice program and the lifting line theory(18) are compared in Table 2.03. The lattice network arrangements and corresponding section lift distributions for the vortex lattice solutions are shown in Figure 2.08. The comparison of the calculated span loadings for the rectangular and the straight tapered wings against lifting line semi-empirical predictions(20, 21) is presented in Figure 2.09. A qualitative evaluation of results shows that the program predictions are in good agreement with the lifting line exact theory and the lifting line semi-empirical predictions.

2.9.3 Wings of Low Aspect Ratio and Large Sweepback

Wing planforms of low aspect ratio having no twist and large leading edge sweepback angles for which comprehensive wind tunnel test data are available are considered.(23, 24) The range of wing planforms includes delta, clipped delta, and straight tapered configurations of aspect ratios ranging from two to four and leading edge sweepback angles as large as 60° (see Table 2.04). The airfoil sections are relatively thin ($\sim$ 3 percent) with sharp or rounded nose sections. Under these conditions locally separated flow at the wing leading edge with the accompanying vortex lift and loss of leading edge suction force occurs. Analytical solutions for the wing plan-

forms were generated by the program assuming no separated flow and fully separated flow at the leading edges. Analytical predictions for the integrated airload coefficients are compared with the experimental test results in Table 2.04. Comparisons for a range in angle of attack from 0° to 25° are shown for four representative wing planforms in Figures 2.10 through 2.12. Comparisons of the lift distribution on the lifting surface for a delta wing planform are presented in Figure 2.13. The analytical solutions in the table and the figures were calculated assuming a control point location of 77 percent of chord for the elemental panels. An evaluation of the overall results leads to the following conclusions.

1) The analytical solutions for the integrated wing lift coefficients are found in excellent agreement with the wind tunnel test results (Figure 2.10). In general, the analytical solutions with and without leading edge suction bound the experimental results.

2) Analytical solutions for the wing drag coefficients when compared with the experimental results, although in less agreement, showed the same trends as for the lift (Figure 2.11).

3) The analytical solutions for the integrated wing pitching moment coefficients about the 1/4 of the mean geometric chord are not found to be in good agreement with the wind tunnel test results (Figure 2.12). Differences of the order of 25 percent are encountered for the delta wing planform of aspect ratio of two and somewhat smaller for the other wings. The reasons for the discrepancies encountered for the pitching moment probably arise from two sources. First, the test data for the wings were deduced from tests conducted for wings with a slender fuselage. To obtain the characteristics of wing alone, data for the fuselage alone was subtracted from the wing-fuselage data and, as a result, the wing-fuselage interference effect was neglected. Second, for the delta wing configurations the calculated lift in the tip regions is extremely large while in the real test environment stalling in these regions would surely occur. This would result in a redistribution of the vorticity on the wing upper and lower surfaces which cannot be represented accurately by the vortex lattice theory (see Figure 2.13). In addition, it should be noted that the pitching moment error for the $\overline{C}/4$ location is somewhat

misleading in assessing the accuracy of the vortex lattice method since at this location the magnitude of the pitching moment is of zero order, i.e., more than an order of magnitude smaller than the wing lift coefficient. The error in the pitching moment predictions for the $\overline{C}/4$ location (Figure 2.12) represents a difference of about 2.5 % of $\overline{C}$ on the location of the center of pressure at moderate angles of attack ($\alpha < 5^{o}$) that is equivalent to about 1% of the maximum chord length of the wing. Another point worth noting is that the vortex lift was found to be many times smaller than the wing lift calculated by the vortex lattice method. Therefore, the approximate treatment of the vortex lift by the suction analogy is considered satisfactory in determining the net airload sum for the wing.

2.9.4 Ground Effects

Analytical solutions that include the ground effects are obtainable by the method of images by assuming the ground plane to be perfectly flat and of infinite extent. Under these conditions, the boundary requirements for the flow at the ground plane are exactly satisfied by defining a wing image located directly below the wing at a distance equal to twice the altitude from the ground plane. For altitudes equal or greater than one chord length, the lifting line and the lifting surface analytical techniques provide comparable and accurate solutions to the problem. When the altitude from the ground plane is diminished below the one-chord length, the chordwise distribution of circulation is very strongly affected by the presence of the ground plane. In this range of altitudes, only the lifting surface methods such as the vortex lattice analysis technique can be expected to provide accurate solutions.

The accuracy of the present program for predicting ground effects may be demonstrated by comparing analytical solutions against lifting line predictions[25, 26] and experimental test results.[26] In accomplishing these objectives, ground effects were calculated for three different wing planforms for which comprehensive wind tunnel test and/or flight data are available. A comparison of results is shown in Figure 2.14. In examining the figure, the following observations are made:

1) For the rectangular wing planform of aspect ratio of six shown in the figure (Figure 2.14[A]), the program predictions of the ground effects are found to be in perfect agreement with the flight test

data[26] for the range of altitudes tested. As expected, the lifting line theory[25, 26] is inaccurate very near the ground plane ($H/\overline{C} \leq 1$).

2) For the straight tapered wing of aspect ratio of ten (Figure 2.14[B]), the program predictions are found in very good agreement with the experimental data obtained in the wind tunnel.[27] Again, at distances very near the ground plane, the lifting line theory[26] proves to be inaccurate. An illustration of the corresponding variation of the span lift distribution due to the ground effects is also shown in the figure.

3) For a delta wing of aspect ratio of 2.309 (Figure 2.14[C]), the present program predictions are compared with semi-empirical results reported by Fox.[28] The analytical predictions of the ground effects by the program are found not to be in very good agreement with these results. However, the accuracy of this data is suspected since the wing lift coefficient out-of-ground is found to be about 20 percent larger than reported by other investigators for comparable delta wing planforms operating at the same angle of attack[23, 24] (see Figure 2.10, Configuration C1).

2.9.5 Wings of Unusual Planforms

Analytical predictions of the aerodynamic characteristics for wings having large sweepback angles and unusual planforms obtained by the present program and the lifting line theory[29, 30] are compared in Figures 2.15 and 2.16. In the first figure, the span loading distribution predictions for three different wing planforms of aspect ratio of six having continuous and broken sweepback of 45° at the 1/4 chord are presented. In all three cases good agreement is found between the vortex lattice and the lifting line predictions. Although the larger discrepancies are found at the root region, the small differences encountered in the span loading predictions are probably due to the greater accuracy of the vortex lattice method for representing the real problem. Predictions for the lift slope and the location of the center of pressure on the wing surface also shown in the figure are found to be in good agreement. In the second figure (Figure 2.16), predictions of the effect of varying the sweepback angle on the wing lift slope for straight tapered wings of aspect ratio of six are compared. Again, a comparison between the vortex lattice and lifting line solutions are found to be in good agreement.

2.9.6 Wings With Severe Surface Discontinuities

The accuracy of the present vortex lattice program for analyzing wing planforms having severe surface discontinuities is considered in this section. Such discontinuities arise from two sources: (1) sharp discontinuities in the wing surface such as: abrupt changes in the wing dihedral, the presence of wing-tip end plates, boundary layer flow fences, etc., and (2) trailing edge surface discontinuities arising from large deflections of control devices such as flaps or ailerons. The solutions for one example of each of these types of discontinuities is considered and compared against experimental results or other theoretical solutions.

1) Wing of Aspect Ratio of Four with End Plates

The exact analytical treatment of arbitrary wing planforms with end plates at the tip can only be performed using the exact geometry (no linearization) in prescribing the boundary conditions. The problem presents the most severe test for the analytical method because of the very large velocities induced in the spanwise directions by the end plate bound vortex filaments. Analytical predictions performed by the present program are compared with experimental results[31] for a rectangular wing of aspect ratio of four with large end plates in Figure 2.17. The analytical results showed a stronger effect of the end plates on the wing lift (about 30 percent larger) than obtained in the wind tunnel experiments. This discrepancy is probably due to the presence of separated flow in the corners of the wing-end plate junctures which would account for the loss of lift.

2) Straight Tapered Wing of Aspect Ratio of Six with Flapped Surfaces

A straight tapered wing of aspect ratio of six having simple trailing edge flapped surface of 25 percent of chord is considered. The flapped surfaces are assumed to be constituted by the wing flaps and the ailerons which extend from the root to the 62.5 percent and from the 62.5 percent wing station to the tip respectively (see Figure 2.18). Analytical solutions were obtained by the program for symmetric and unsymmetric span loadings. Symmetric span loadings were calculated for the wing operating with the flaps extended 30° and the ailerons neutral, and unsymmetric span loadings, by assuming unequal aileron

deflections of 10° down and 15° up for the left and right ailerons respectively. The handling of the flap-aileron junction surface discontinuity was treated using the smoothing procedure described in Section 2.7 using $\delta/(b/2)$ value of 0.20. A summary of the principal results obtained were plotted using the program standard plotting option and are presented in Figure 2.18. A comparison between the results obtained and the lifting line and thin airfoil theory analytical predictions[9] are presented in Table 2.05. As shown in the table, the vortex lattice method predictions for the airload increments due to the flapped surface deflections are found to be smaller than by the other method. The discrepancies in the results probably are due to the fact that in the present vortex lattice method the exact geometry of the wing section camber distributions are considered while for the other method (thin airfoil theory) approximate geometric boundary conditions (which are valid only at very small flapped surface deflections) are used. The fact that the vortex lattice predictions for the wing airloads increments are smaller is a most revealing result. Note that solutions obtained based on thin airfoil theory usually overestimate the effect of the flapped surfaces by about 20 percent.

2.9.7 Multiple-Surface Configurations

The accuracy of the present vortex-lattice analysis program in obtaining solutions for vehicle configurations that are represented by two or more lifting surfaces is to be evaluated in this section. Typical example configurations under this category are: wing + horizontal tail (2 surfaces), wing + canard control surface (2 surfaces), thick wing (2 surfaces), wing + horizontal tail + vertical tail + fuselage (4 surfaces), lifting body (2 or more surfaces), etc. The significant characteristic of the multiple-surface problem is the mutual influence or interference effect that each surface exerts on all the other surfaces. Such problems can only be properly analyzed by the vortex-lattice and surface-integral[7] methods. In determining the accuracy of the present analysis, analytical predictions were performed for three representative vehicle configurations for which wind-tunnel or flight data of sufficient quantity and accuracy is available. The results obtained, a comparison between analytical predictions versus experimental data, are presented in Figures 2.19 through 2.21. The vehicle con-

figurations and type of experimental data sources studied were as follows: 1) out-of-ground wind tunnel tests conducted for a wing + canard surface + slender fuselage model in Reference 32, 2) flight test data in and out of ground conducted for the Douglas F5D-1 prototype airplane with a modified ogee wing,[33] and 3) flight test data in- and out-of-ground for the North American XB-70 Airplane.[33] In examining the comparisons presented in the figures, it must be concluded that the present vortex-lattice analysis method is capable of predicting the aerodynamic loads within a few percent (1 percent to 5 percent) of the experimental results. The details of the technical evaluation that led to this conclusion are discussed below.

1) Out-of-Ground Predictions

Analytical predictions for lift, induced drag, and pitching moment for the wing-canard-fuselage model are compared against wind tunnel test results in Figure 2.19. The predictions for the lift coefficient are found to be in remarkable agreement with the test data, i.e., within one percent. This result was obtained notwithstanding of the very strong mutual interference effect that the canard surface exerts on the wing that is predicted by the analysis (see Table 2.06). The induced drag predictions are also found to be in very good agreement with the test data, especially if it is taken into account the fact that the magnitude of the induced drag force is much smaller (by a Factor of $\sim$ 10) in comparison with the lift force. Similarly, comparisons for the pitching moment are given about the C.G. and the trailing-edge of the wing root chord. Although a very large discrepancy is found between the predicted and the test data for the pitching moment when expressed about the C.G., the scale of the pitching moment here is very small and misleading. By expressing the pitching moment about the aftermost location of the wing surface, the trailing-edge of the wing root chord, a more meaningful evaluation of results is possible. This fact can be corroborated by calculating the discrepancy of the location of the center of pressure that reveals the cause for the discrepancy in the pitching moment. Accordingly, the predicted location of the center of pressure when compared against the test data is off by about ten percent of the wing $\overline{C}$, or, about three percent of the

model length. Since varying the vortex-lattice arrangement or the number of control points showed no significant change on the predictions, it is concluded that the analytical predictions represent an exact solution. Then, the small discrepancy encountered in the pitching moment (Figure 2.19d) or center of pressure location can only be attributed to wind tunnel test measurement errors or to the fact that the exact geometry of the wind tunnel model was only approximately represented by the vortex-lattice arrangement used in carrying out the calculations of analytical predictions.

2) <u>In-Ground-Predictions</u>

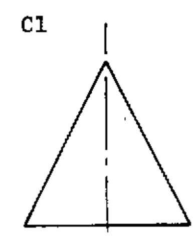
Analytical predictions for the lift of full-size vehicles in flight in the presence or absence of a very near ground plane are compared against flight test data[34] in Figures 2.20 and 2.21. In general, relative good agreement is found between the analytical predictions and the flight test data. Although better agreement is found for the out-of-ground comparisons, this finding is not surprising when considering the great difficulties encountered in obtaining accurate data very near the ground plane. Corrections on the lift due to varying control surface deflections, jet thrust, etc., that include the ground effect are difficult to assess and are generally ignored.

TABLE 2.01 - VORTEX-LATTICE GEOMETRY EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HA010B) FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT α = 10° AND M = 0.25

	VORTEX MATRIX GEOMETRY					WITH L. E. SUCTION (BLUNT L. E.)			NO L. E. SUCTION (SHARP L. E.)			EXECUTION TIME
	NO. SPAN ELEMENTS	SPAN SPACING†	NO. CHORD ELEMENTS	CHORD SPACING†	TOTAL NO. ELEMENTS	C_L	C_{D_i}	$C_{M(\bar{C}/4)}$	C_L	C_{D_i}	$C_{M(\bar{C}/4)}$	SECONDS‡
1	14	0	5	0	70	0.3708	0.0476	-0.0825	0.4071	0.0722	-0.0882	39
2	14	1	5	0	70	0.3765	0.0472	-0.0845	0.4149	0.0735	-0.0905	38
3	14	0	5	1	70	0.3717	0.0488	-0.0801	0.4074	0.0729	-0.0860	39
4	14	1	5	1	70	0.3770	0.0478	-0.0830	0.4152	0.0739	-0.0890	39
5	20	0	5	0	100	0.3739	0.0486	-0.0827	0.4098	0.0729	-0.0885	73
6	20	1	5	0	100	0.3765	0.0483	-0.0843	0.4141	0.0734	-0.0904	73
7	20	1	5	1	100	0.3772	0.0495	-0.0818	0.4137	0.0738	-0.0881	74
8	14	1	9	0	136	0.3752	0.0477	-0.0837	0.4127	0.0733	-0.0895	106

†LEGEND
1 = COSINE SPACING
0 = CONSTANT SPACING

‡EXECUTION TIME INCLUDES LINEAR ARRAY SOLUTIONS



AR = 2

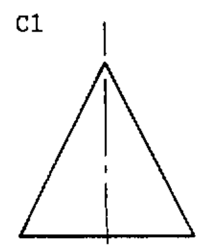
TR = 0

$\Lambda_{\bar{C}/4}$ = 56°

TABLE 2.02 - VORTEX-LATTICE CONTROL POINT LOCATION EFFECT ON THE CALCULATED WING AIRLOADS (PROGRAM HA010B) FOR A DELTA WING OF ASPECT RATIO = 2, OPERATING AT α = 10^{0} AND M = 0.25

LOCATION OF CONTROL POINT % OF ELEMENT CHORD		75%	80%	83%	77%
VORTEX MATRIX GEOMETRY	NO. SPAN ELEMENTS	14	14	14	14
	SPAN SPACING†	1	1	1	0
	NO. CHORD ELEMENTS	5	5	5	5
	CHORD SPACING†	0	0	0	0
WITH L. E. SUCTION (BLUNT L. E.)	C_L	0.3673	0.3908	0.4044	0.3708
	C_{D_i}	0.0462	0.0527	0.0568	0.0476
	$C_{M(\bar{C}/4)}$	-0.0846	-0.0838	-0.0823	-0.0825
NO L. E. SUCTION (SHARP L. E.)	C_L	0.4051	0.4359	0.4602	0.4071
	C_{D_i}	0.0714	0.0769	0.0812	0.0722
	$C_{M(\bar{C}/4)}$	-0.0903	-0.0892	-0.0885	-0.0882

†LEGEND
1 = COSINE SPACING
0 = CONSTANT SPACING



AR = 2
TR = 0
$\Lambda_{\bar{C}/4}$ = 56^{0}

TABLE 2.03 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO

	GEOMETRY				AERO COEFFICIENTS AT $\alpha = 10°$, $M = 0$				
ANALYSIS	PLANFORM	ASPECT RATIO	TAPER RATIO	SWEEP $\Lambda(\bar{C}/4)$	C_L	$C_{M(\bar{C}/4)}$	C_{D_i}	WING LIFT SLOPE C_L/DEG	WING A. C. % $\bar{C}$
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 75%	RECTANGULAR	6	1	0	0.7567	0.0004	0.0355	0.07567	24.99
	TAPERED	6	1/3	0	0.7795	0.0031	0.0367	0.07795	24.59
	ELLIPTICAL	6.04	0	0	0.7865	-0.0211	0.0377	0.07865	27.71
NACA REPORT NO. 631 [18] SECTION LIFT SLOPE $a_o = 2\pi \times 57.3$	RECTANGULAR	6	1	0	0.7870	0	0.0345	0.07870	25.00
	TAPERED	6	1/3	0	0.8195	0	0.0363	0.08195	25.00
	ELLIPTICAL	6	0	0	0.8220	0	0.0358	0.08220	25.00
TRW VORTEX-LATTICE METHOD (PROGRAM HA010B) CONTROL POINT AT 77%	RECTANGULAR	6	1	0	0.7779	0.0068	0.0373	0.07779	24.12
	TAPERED	6	1/3	0	0.8011	0.0097	0.0387	0.08011	23.78
	ELLIPTICAL	6.04	0	0	0.8081	-0.0149	0.0398	0.08081	26.84
NACA REPORT NO. 631 [18] SECTION LIFT SLOPE $a_o = 0.099$ (NACA0012 AIRFOIL)	RECTANGULAR	6	1	0	0.7286	0.0044	0.0295	0.07286	24.40
	TAPERED	6	1/3	0	0.7564	0.0045	0.0307	0.07564	24.40
	ELLIPTICAL	6	0	0	0.7610	0.0046	0.0307	0.07610	24.40

TABLE 2.04 - WING AIRLOAD PREDICTION COMPARISONS FOR WING PLANFORMS OF MODERATE ASPECT RATIO AT $\alpha = 5^{o}$

CONFIGURATION					TEST CONDITIONS		ANALYSIS† (PROGRAM HA010B)		EXPERIMENT	WING AIRLOAD COEFFICIENTS			C. P. LOCATION
PLANFORM	ASPECT RATIO	TAPER RATIO	SWEEP ANGLE $\Lambda(\bar{C}/4)$	AIRFOIL SECTION	MACH NUMBER	REYNOLDS NUMBER	WITH L. E. SUCTION (BLUNT L. E.)	NO L. E. SUCTION (SHARP L. E.)	NACA RM A53A30	C_L	C_{D_i}	$C_{M(\bar{C}/4)}$	% $\bar{C}$
DELTA	2	0	56.0°	NACA 0003-63	0.25	16.6×10^6	X			0.1849	0.0193	-0.0423	47.87
								X		0.1941	0.0248	-0.0435	47.41
									X	0.1830	0.0165	-0.0333	43.19
DELTA	3	0	45.0°	NACA 0003-63	0.25	10.6×10^6	X			0.2433	0.0210	-0.0412	41.93
								X		0.2547	0.0304	-0.0422	41.56
									X	0.2390	0.0200	-0.0332	38.89
DELTA	4	0	37.0°	3% THICK ROUNDED NOSE SECTION	0.25	9.1×10^6	X			0.2893	0.0215	-0.0384	38.27
								X		0.3029	0.0348	-0.0391	37.90
									X	0.2830	0.0255	-0.0299	35.56
TAPERED	3.08	0.39	11.5°	3% THICK BICONVEX SECTION	0.25	8.3×10^6	X			0.3104	0.0216	-0.0007	25.22
								X		0.3214	0.0362	+0.0023	24.28
									X	0.2860	0.0278	+0.0121	20.76
TAPERED	3	0.40	40.6°	3% THICK BICONVEX SECTION	0.25	8.4×10^6	X			0.2615	0.0213	-0.0203	32.76
								X		0.2722	0.0319	-0.0186	31.83
									X	0.2710	0.0275	-0.0175	31.45
RECTANGULAR	2	1.0	0°	3% THICK BICONVEX SECTION	0.61	4.4×10^6	X			0.3000	0.0254	0.0000	25.00
								X		0.3109	0.0352	+0.0031	24.00
									X	0.2650	0.0271	+0.0150	19.339
CLIPPED DELTA	2	0.33	37.0°	3/8 THICK BICONVEX SECTION	0.61	4.8×10^6	X			0.2800	0.0295	-0.0226	33.07
								X		0.2918	0.0336	-0.0204	31.99
									X	0.2600	0.0310	-0.0161	31.92

†COLOCATION POINT LOCATION AT 77% OF ELEMENT CHORD AND $c_{d_o} = 0.007$ WERE USED IN THE ANALYSIS.

TABLE 2.05 - COMPARISON OF CALCULATED AIRLOAD COEFFICIENT INCREMENTS DUE TO FLAP DEFLECTION FOR A 25% OF CHORD FLAPPED SURFACE

	SECTION COEFFICIENT INCREMENTS PER DEGREE OF FLAP DEFLECTION AT Y/(b/2) = 0.40			
	$\Delta c_\ell/\delta_f^\circ$	$\Delta c_m(C/4)/\delta_f^\circ$	$\Delta c_n/\delta_f^\circ$	$\Delta c_h/\delta_f^\circ$
VORTEX LATTICE METHOD (PROGRAM HA010B)	0.040	-0.01166	0.0566	-0.0140
LIFTING LINE THEORY (WAKE II PROGRAM[9])	0.0672	-0.01138	0.0487	-0.0164

Note: The results presented were calculated for a 25% chord flap deflected 30° with the wing operating at zero angle of attack (See Figure 2.18).

TABLE 2.06 - MULTIPLE-LIFTING-SURFACES INTERFERENCE EFFECT PREDICTIONS (HA0010B) FOR A SELECTED WING-CANARD-FUSELAGE CONFIGURATION (SEE FIGURE 2.19)

	WING LIFT COEFFICIENT C_{L_π} BASED ON S_π AND $\alpha = 12.5^\circ$				
COMMENT	WING $S_\pi = 694.18$	CANARD $S_\pi = 113.04$	CENTER FUS $S_\pi = 17.53$	FUS NOSE $S_\pi = 26.44$	SUM AT C.G. $S_\pi = 694.18$
WING ALONE	0.7091				0.7091
CANARD ALONE		0.5214			0.0849
WING + CANARD	0.6694	0.4129			0.7366
WING + CANARD + FUS	0.6539	0.3982	0.1420	0.1420	0.7318

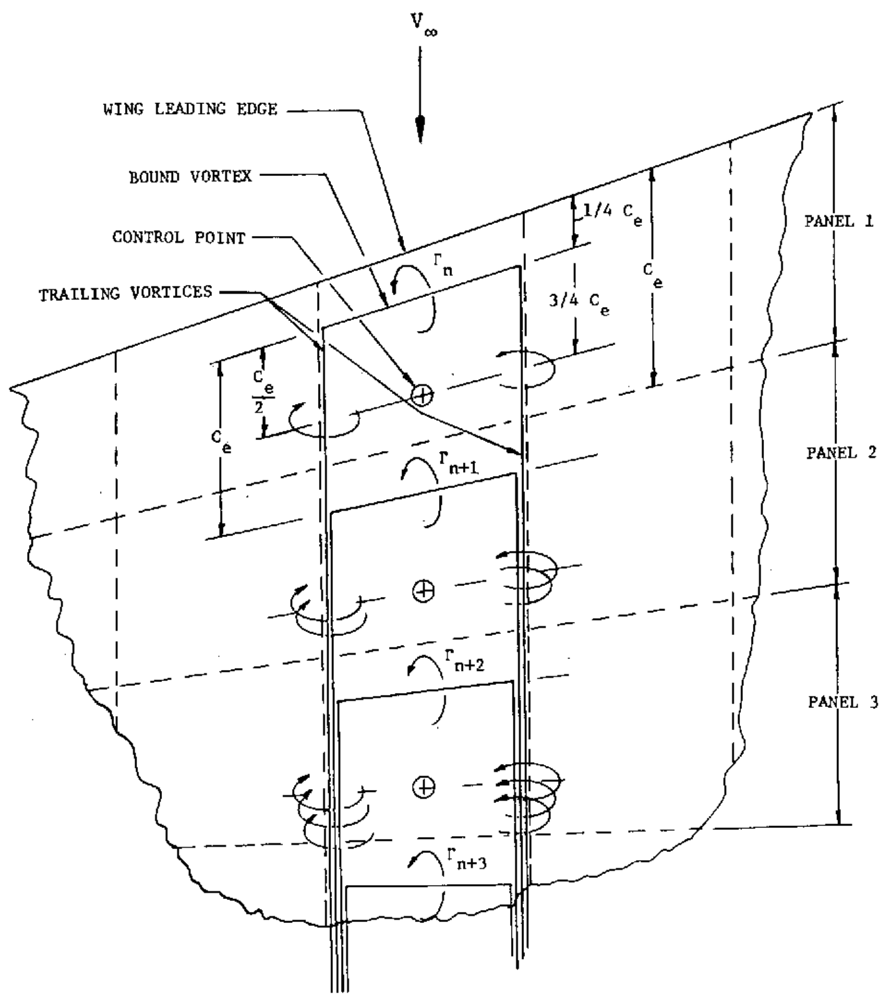


FIGURE 2.01 - SKETCH OF A CHORDWISE ROW OF VORTICES

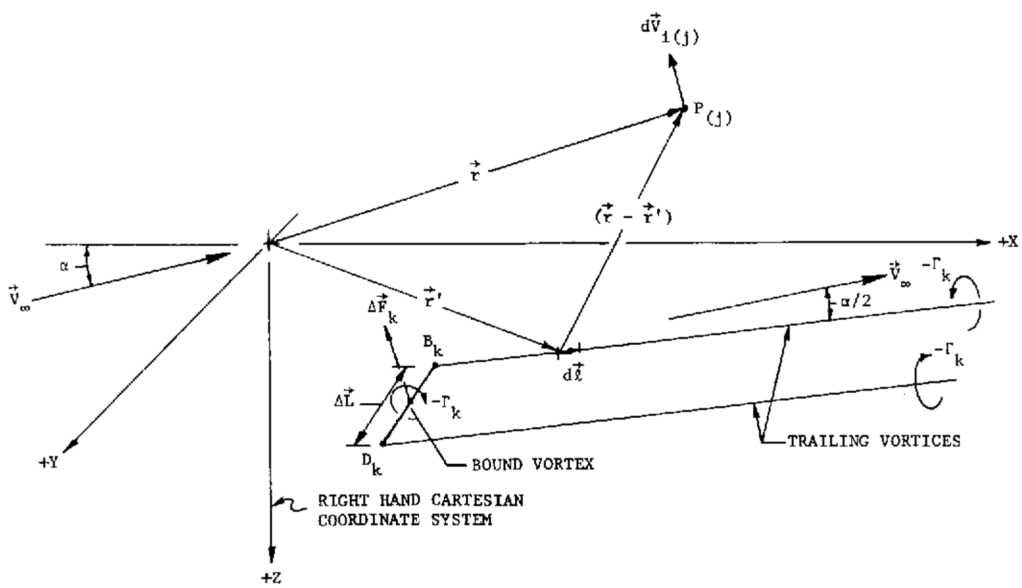


FIGURE 2.02 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT IN THE GENERAL COORDINATE SYSTEM

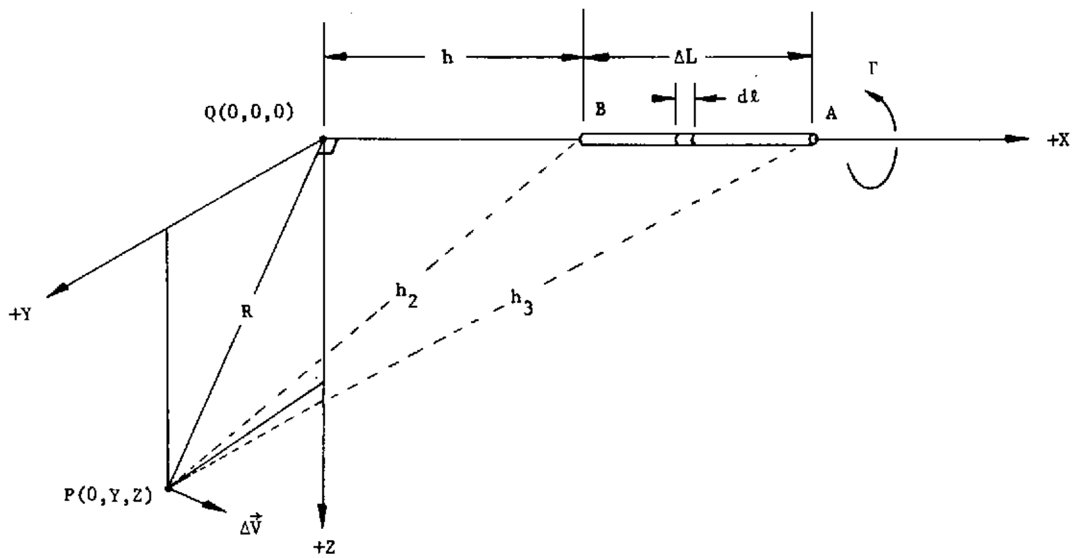


FIGURE 2.03 - VELOCITY INDUCED BY AN ELEMENTAL VORTEX FILAMENT OF LENGTH ΔL DEFINED IN A LOCALIZED COORDINATE SYSTEM

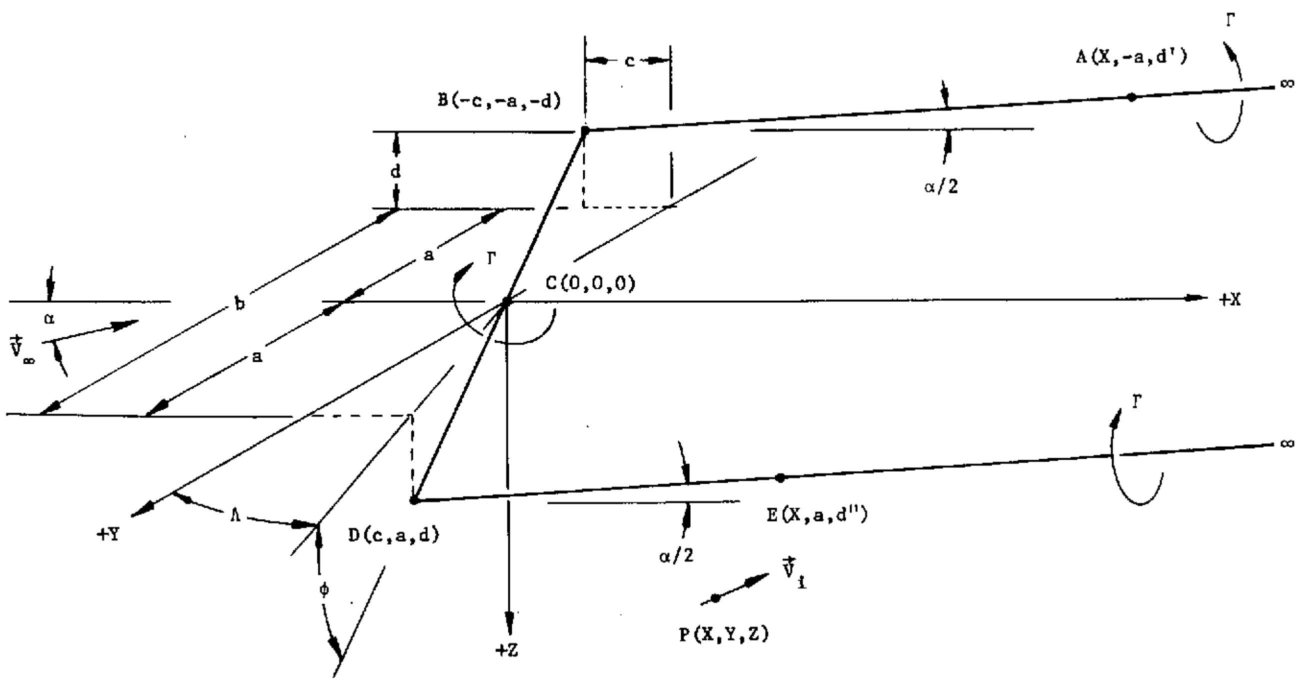


FIGURE 2.04 - GEOMETRY CONVENTION FOR A SKEW-SHAPED HORSESHOE VORTEX FILAMENT DEFINED IN THE LOCAL COORDINATE SYSTEM

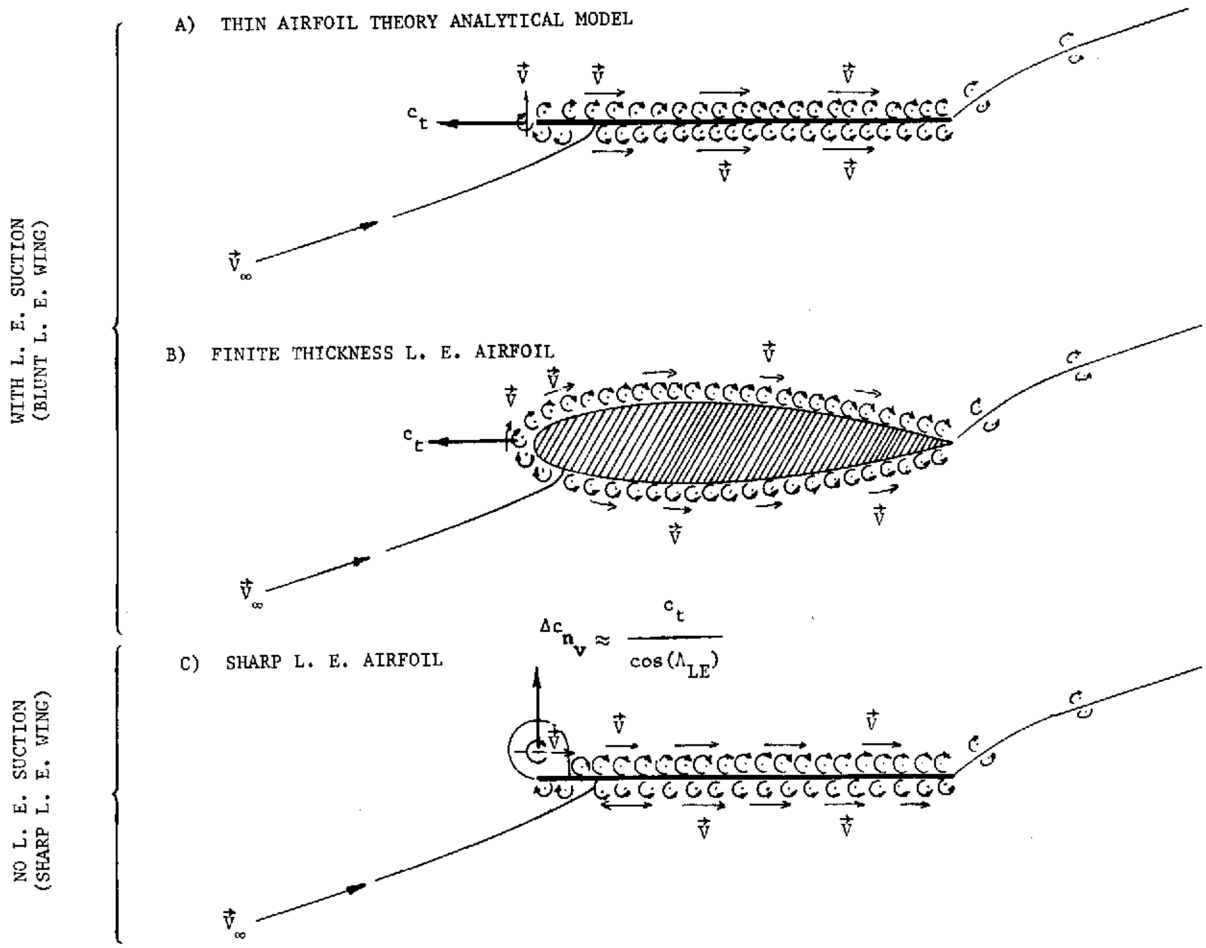


FIGURE 2.05 - ILLUSTRATION OF THE ORIGINS OF THE VORTEX LIFT

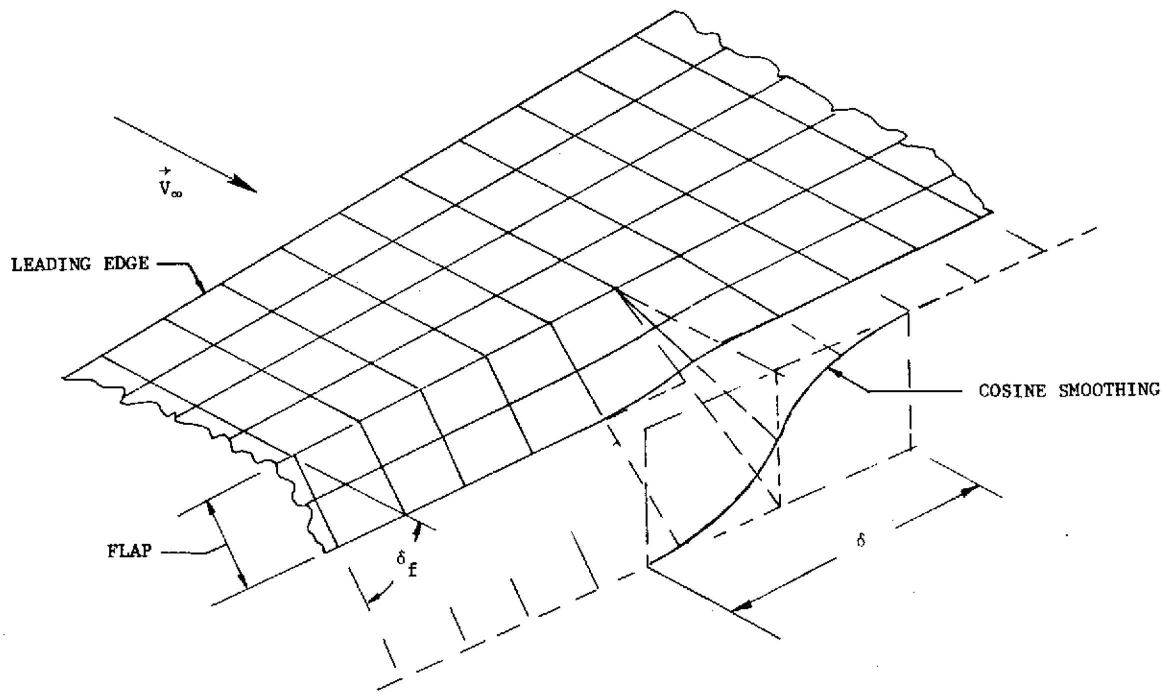


FIGURE 2.06 - COSINE SMOOTHING OF SHARP SURFACE-DISCONTINUITIES

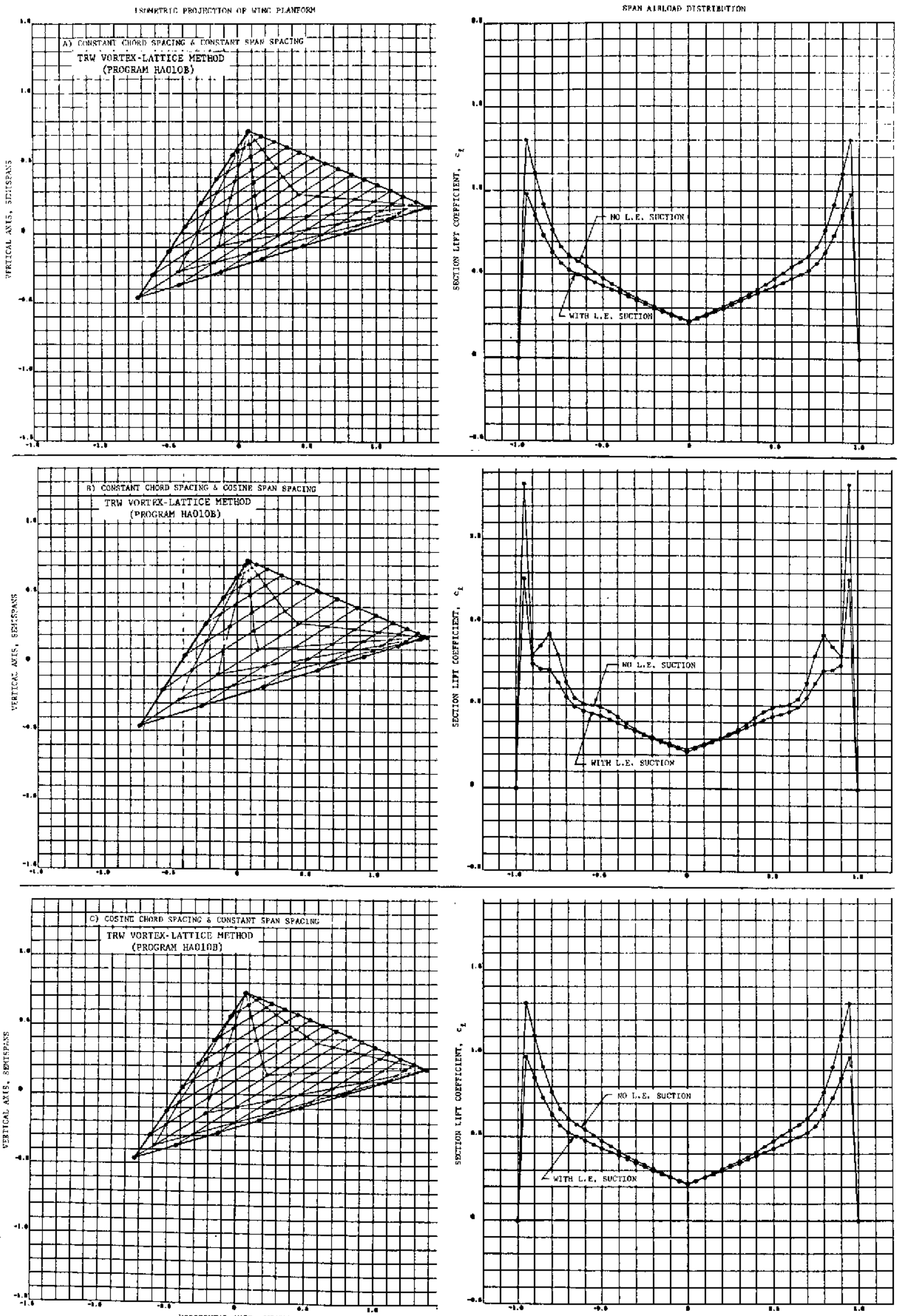


FIGURE 2.07 - VARIATION OF VORTEX-LATTICE ARRANGEMENT EFFECT ON THE SPAN SECTION LIFT DISTRIBUTION FOR A DELTA WING OF ASPECT RATIO = 2 AT AN ANGLE OF ATTACK $\alpha = 10^{\circ}$

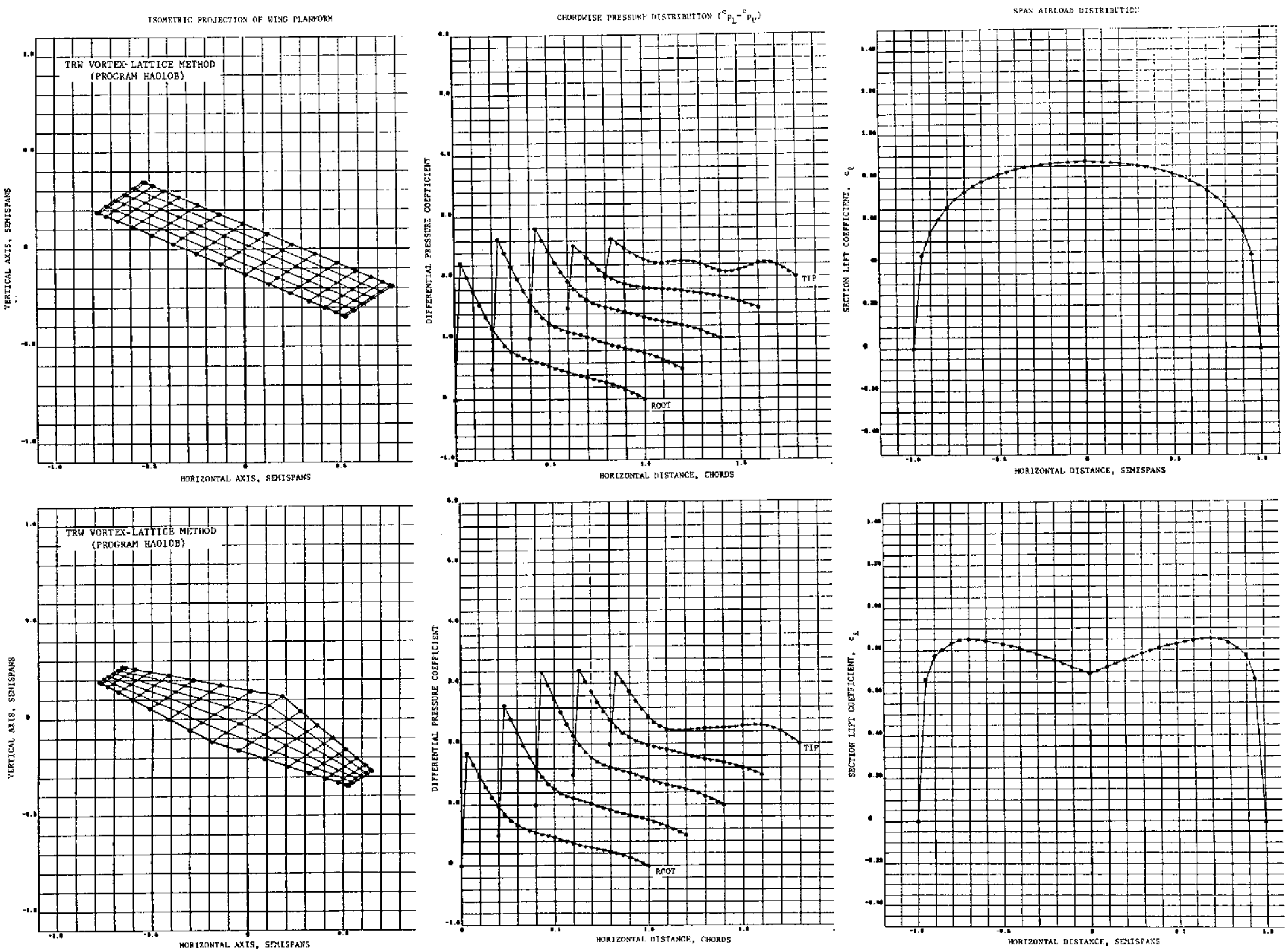


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS AT AN ANGLE OF ATTACK $\alpha = 10^{o}$

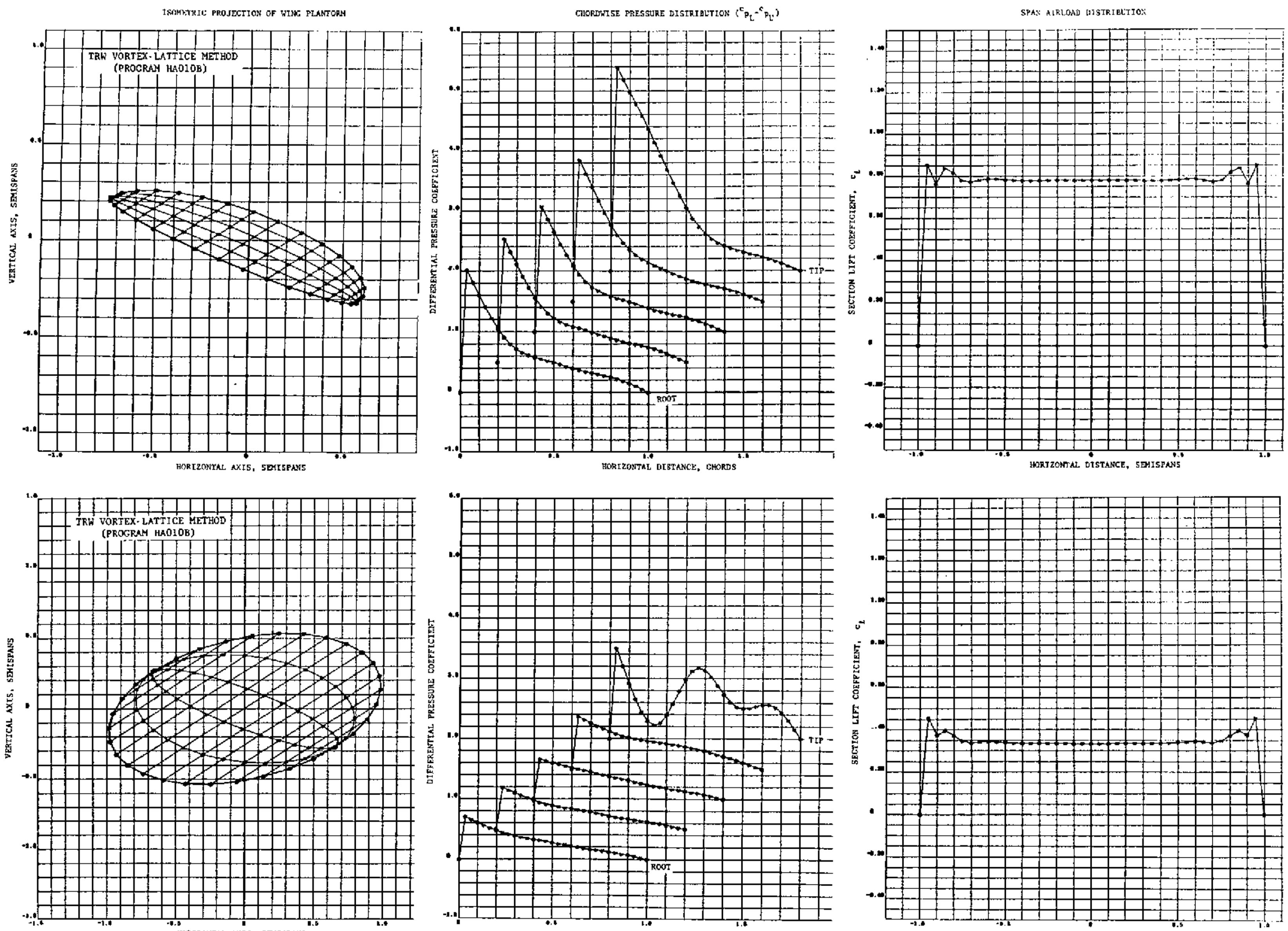
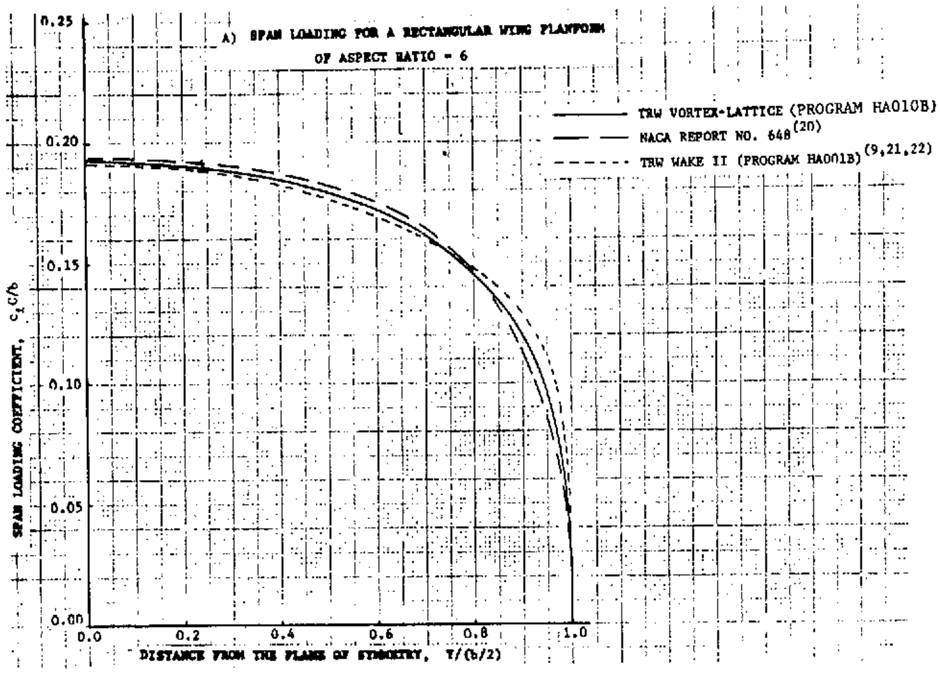


FIGURE 2.08 - LIFT DISTRIBUTION PREDICTIONS (PROGRAM HA010B) FOR FOUR BASIC WING PLANFORMS AT AN ANGLE OF ATTACK $\alpha = 10^{o}$, CONTINUED



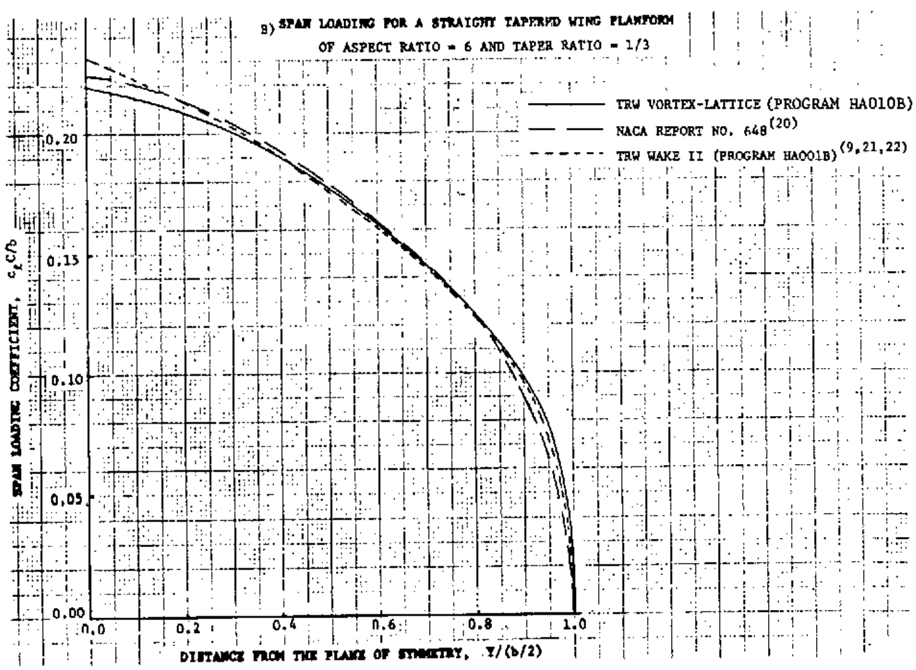


FIGURE 2.09 - SPAN LOADING PREDICTION COMPARISONS FOR TWO BASIC WING PLANFORMS OF ASPECT RATIO = 2

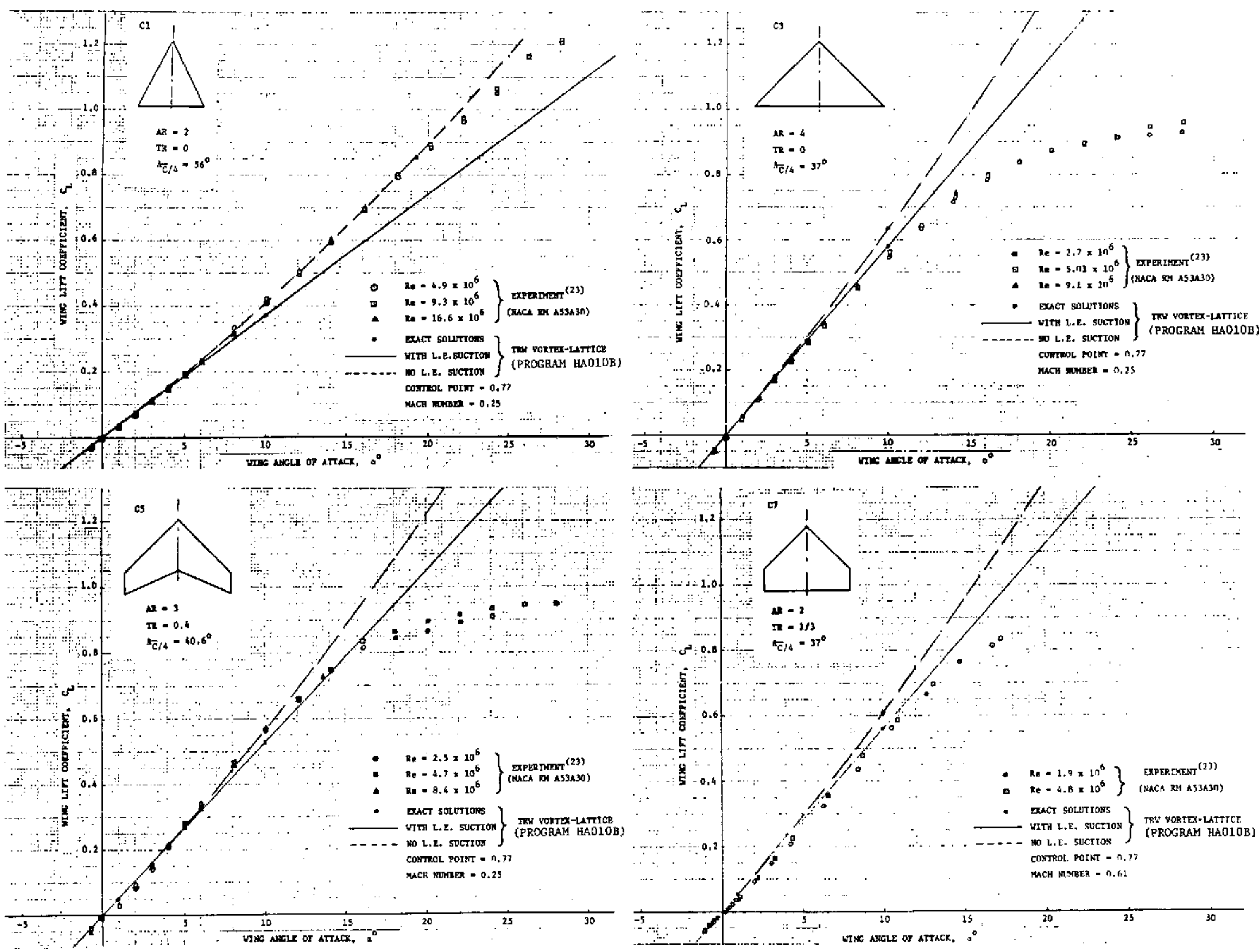


FIGURE 2.10 - WING LIFT PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

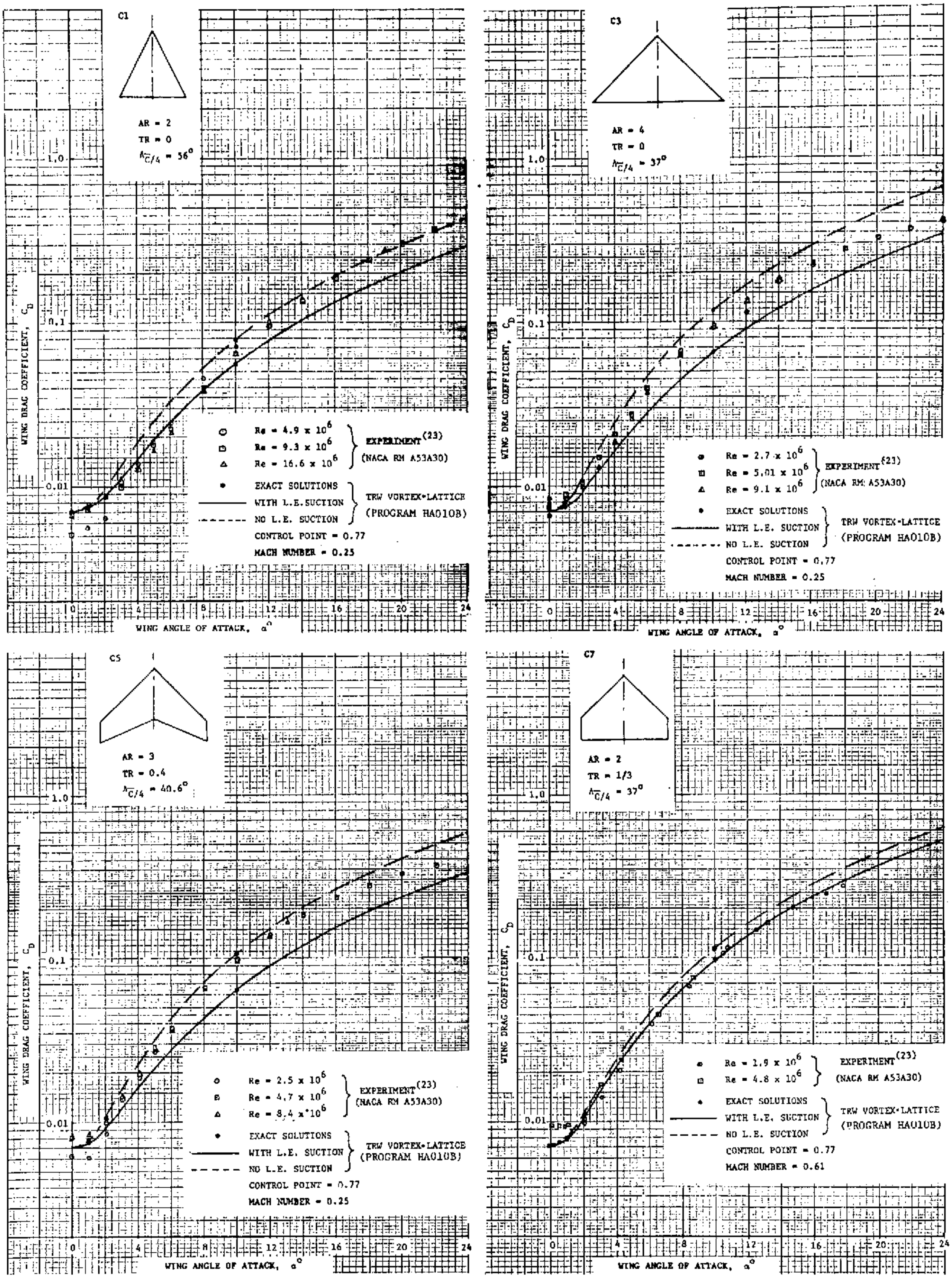


FIGURE 2.11 - INDUCED DRAG PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS

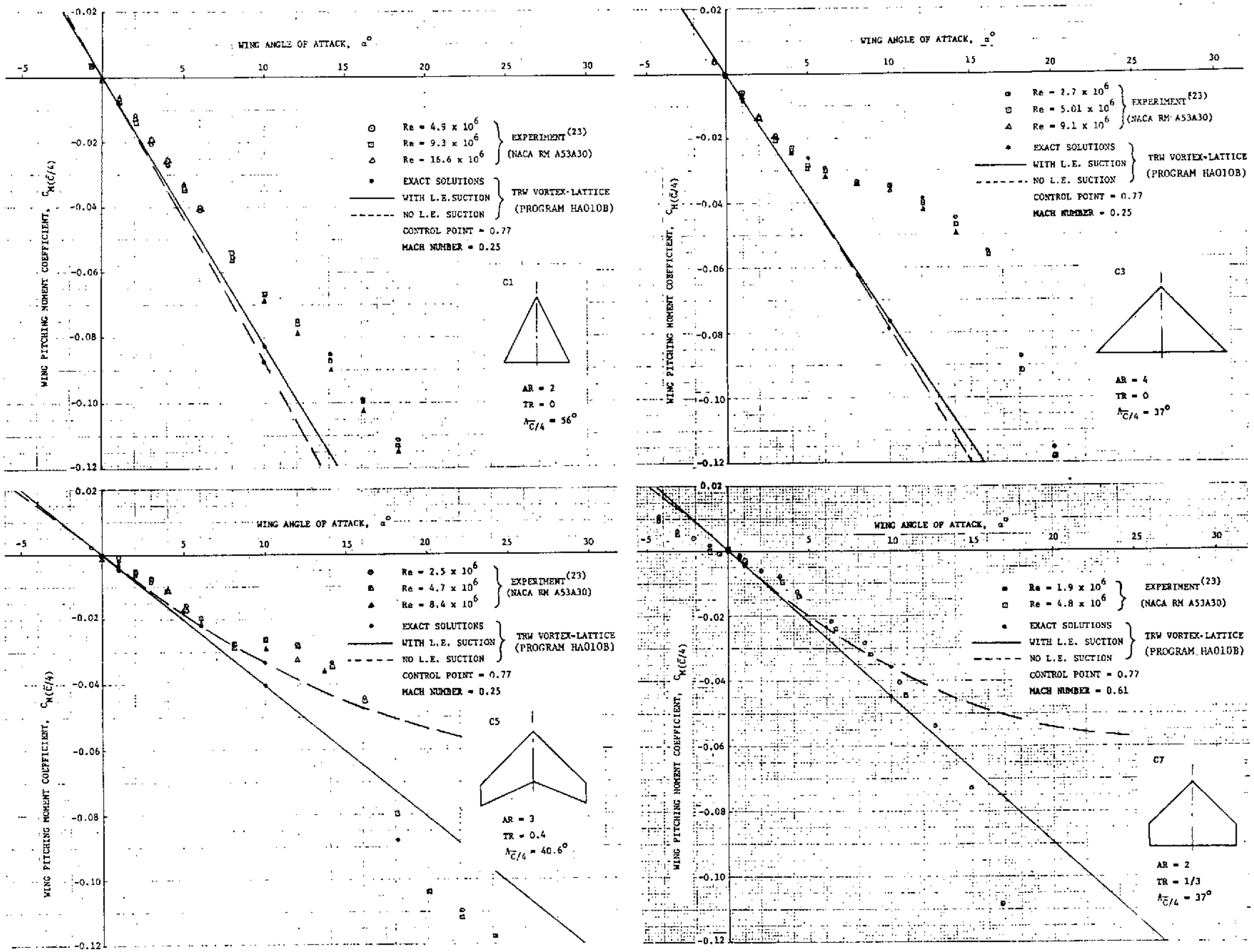
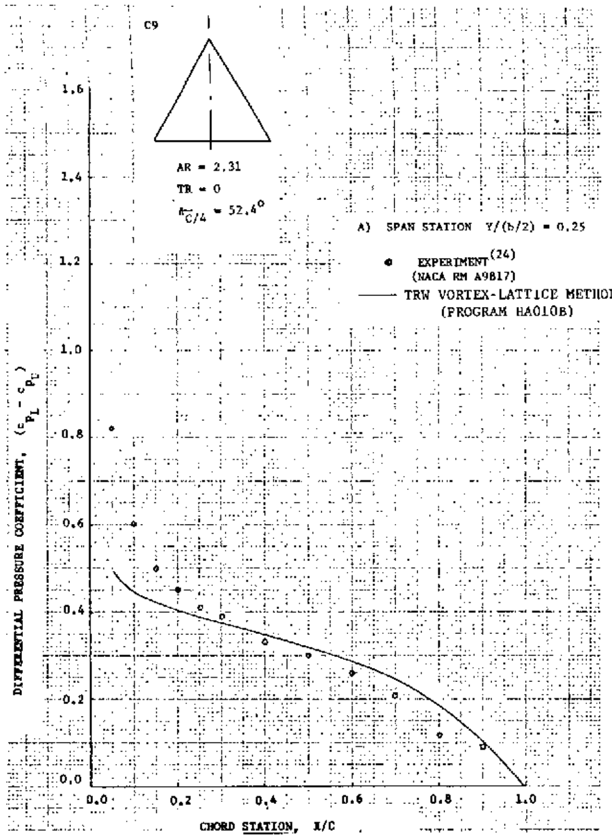
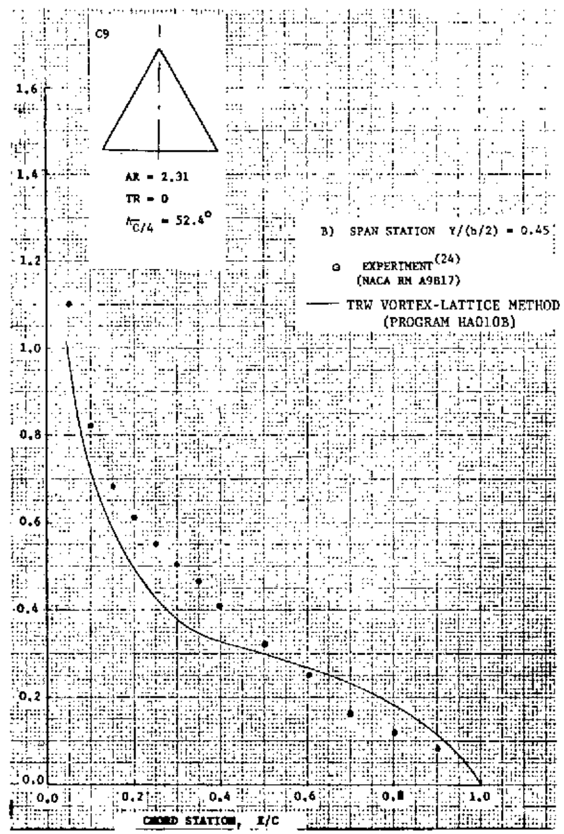
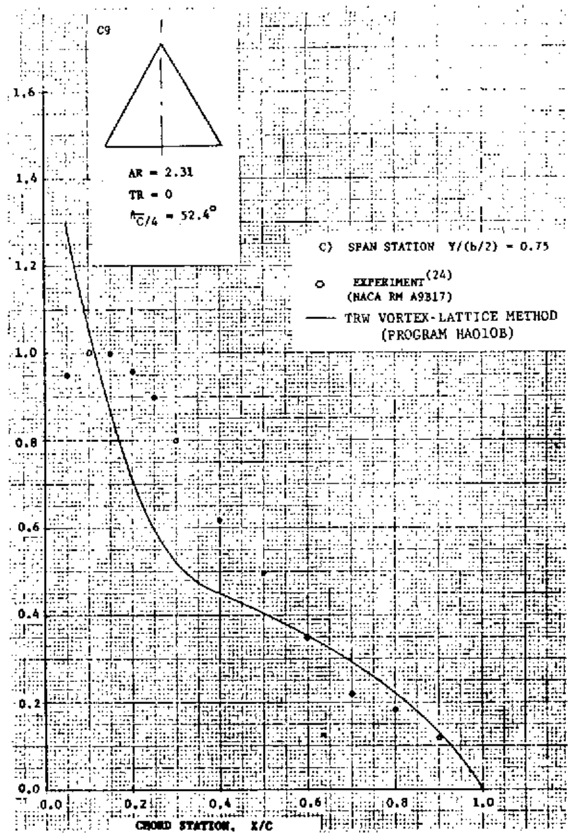


FIGURE 2.12 - PITCHING MOMENT ABOUT $\overline{C}/4$ PREDICTION COMPARISONS FOR SELECTED LOW ASPECT RATIO WING PLANFORMS







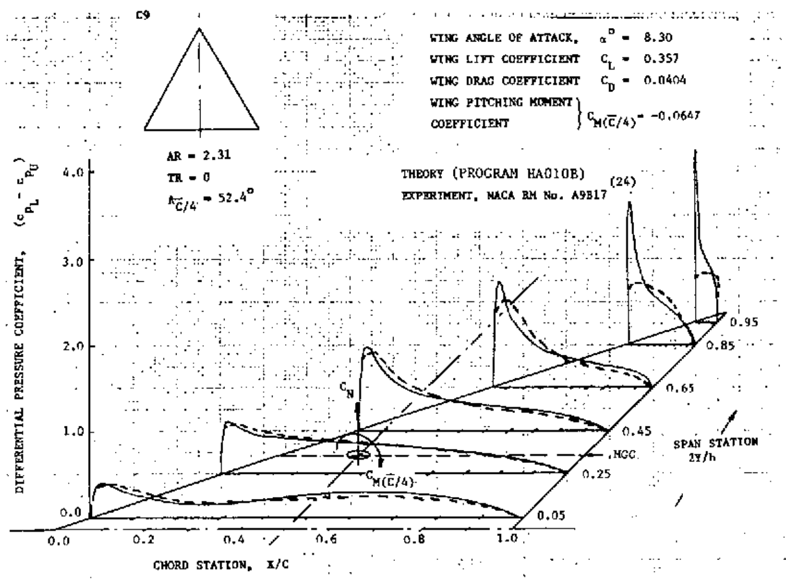


FIGURE 2.13 - LIFT DISTRIBUTION COMPARISONS FOR A DELTA WING OF ASPECT RATIO = 2 OPERATING AT AN ANGLE OF ATTACK α = 8.30°

ORIGINAL PAGE IS OF POOR QUALITY

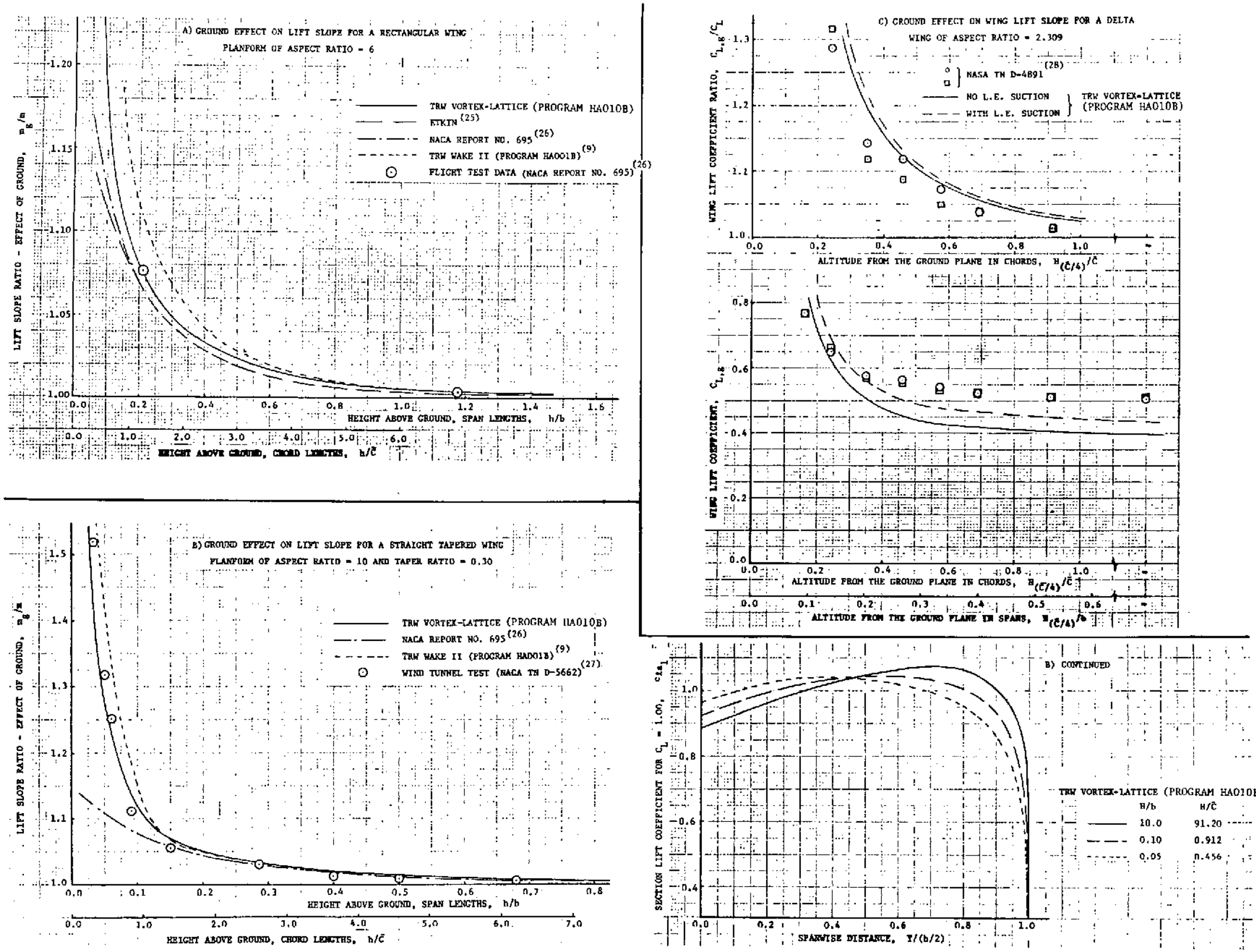
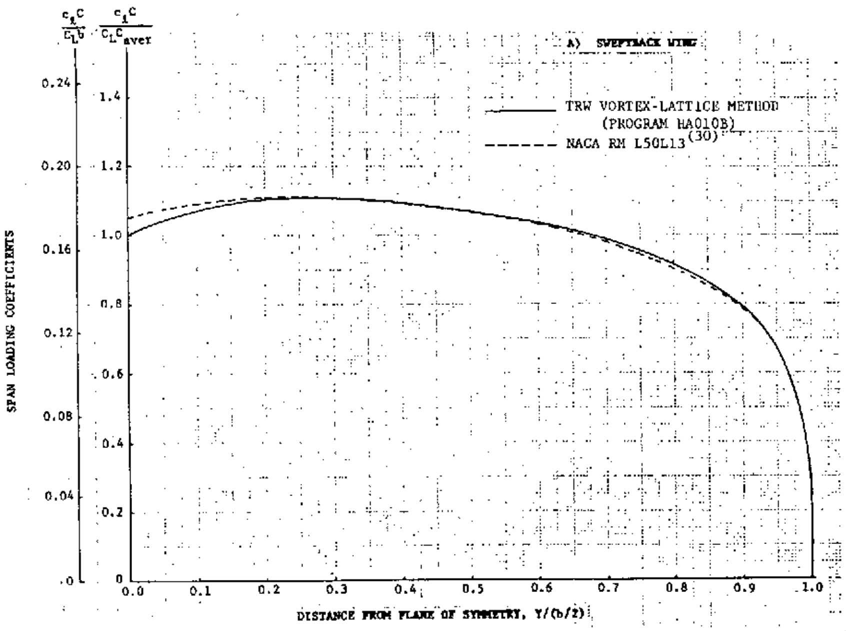
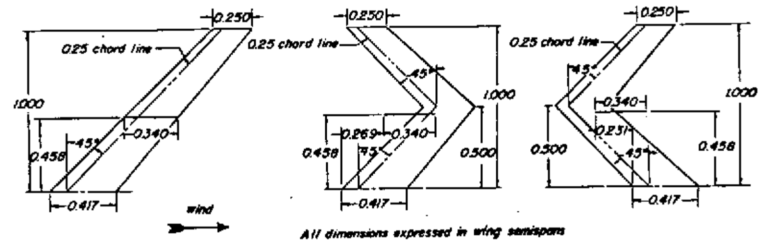


FIGURE 2.14 - WING LIFT PREDICTION COMPARISONS IN THE PRESENCE OF A VERY NEAR GROUND PLANE





Tabulated Wing Data

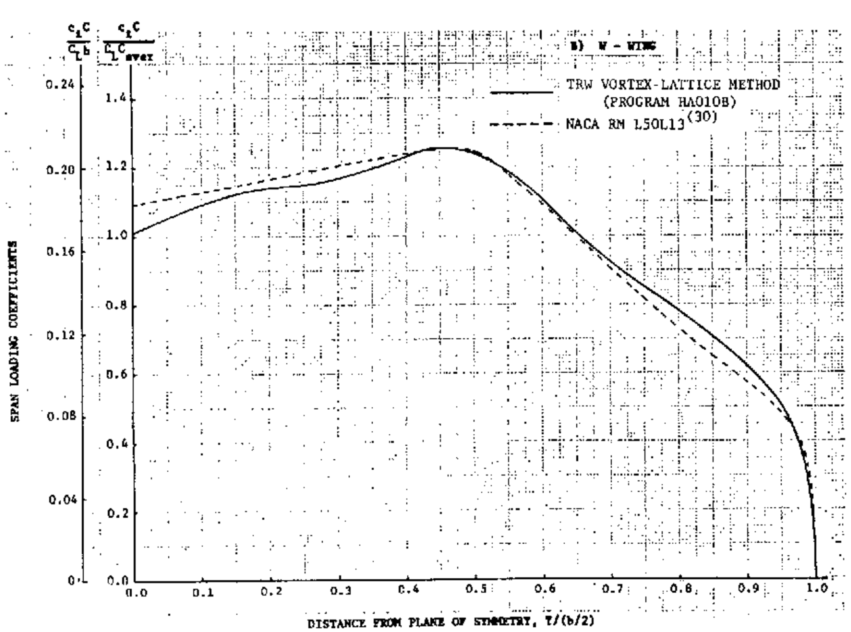
Sweptback wing
- Sweep 45°
- Aspect ratio 6
- Taper ratio 0.6

W-wing
- Sweep of inboard panel 45°
- Sweep of outboard panel -45°
- Aspect ratio 6
- Taper ratio 0.6

M-wing
- Sweep of inboard panel -45°
- Sweep of outboard panel 45°
- Aspect ratio 6
- Taper ratio 0.6

ANALYTICAL METHOD	SWEPTBACK WING			W - WING			M - WING		
	LIFT SLOPE C_L/RADIAN	$Y_{C.P.}$%	A. C.%	LIFT SLOPE C_L/RADIAN	$Y_{C.P.}$%	A. C.%	LIFT SLOPE C_L/RADIAN	$Y_{C.P.}$%	A. C.%
TRW VORTEX LATTICE* (PROGRAM HA010B)	3.1503	47.080	30.616	3.6636	45.034	31.917	3.4312	42.808	28.025
NACA RM L50L13 (30)	3.48**	46.7	27.5	3.55	43.9	31.4	3.53	43.7	26.4

*CONTROL POINT = 3/4 CHORD OF ELEMENTAL PANELS AND VORTEX MATRIX = 20 x 3 WERE USED.
**PROBABLY PRINTED IN ERROR, SHOULD BE 3.23 ACCORDING TO NACA REPORT No. 921.(29)



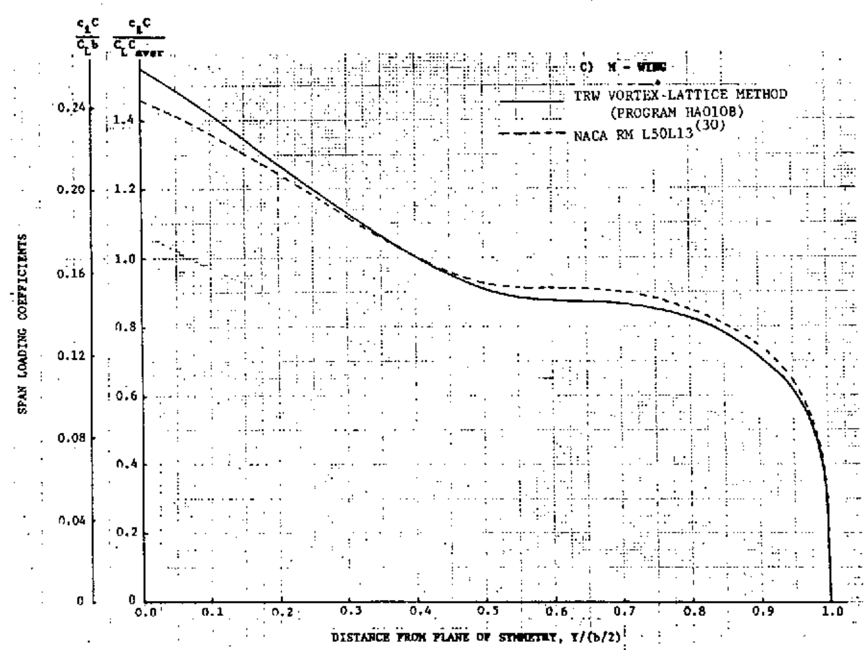


FIGURE 2.15 - LIFT DISTRIBUTION PREDICTION COMPARISONS FOR UNUSUAL WING PLANFORM CONFIGURATIONS

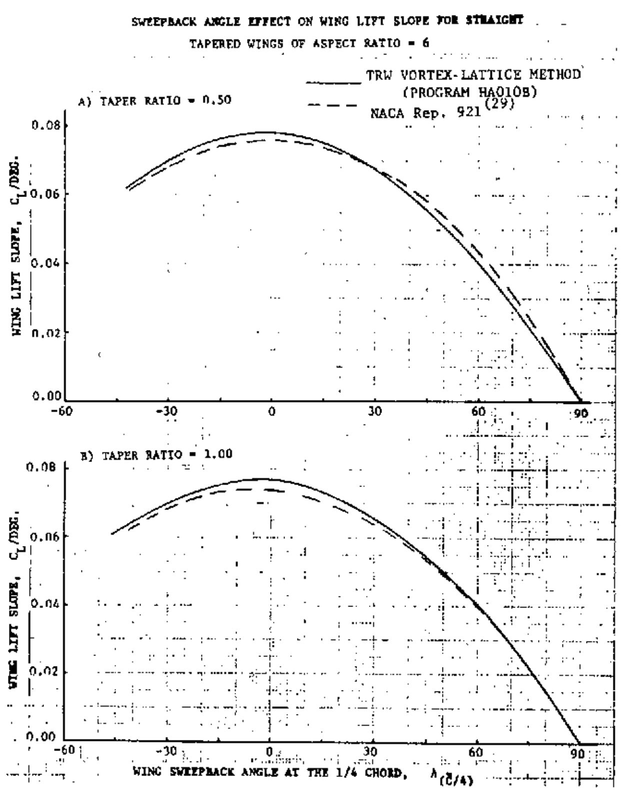
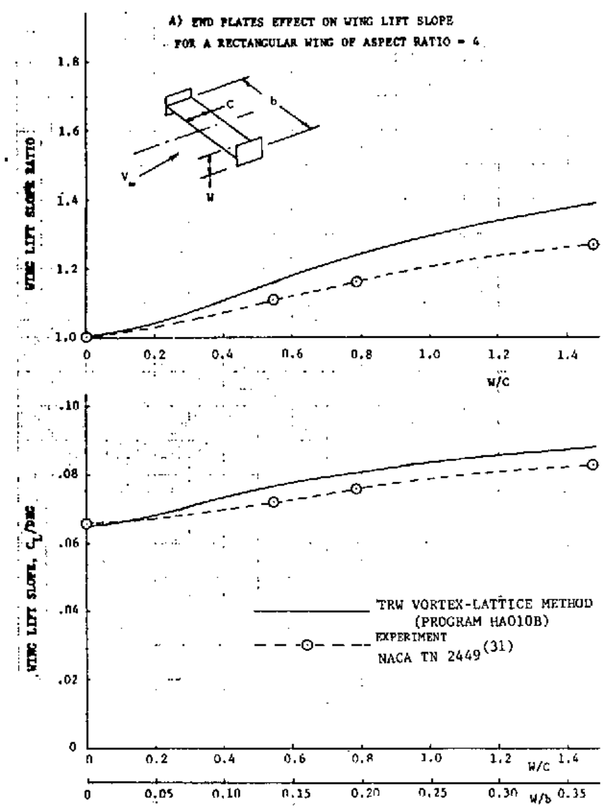


FIGURE 2.16 - SWEEPBACK ANGLE EFFECT ON THE MAGNITUDE OF THE WING-LIFT-SLOPE FOR TAPERED WING PLANFORMS OF ASPECT RATIO = 6



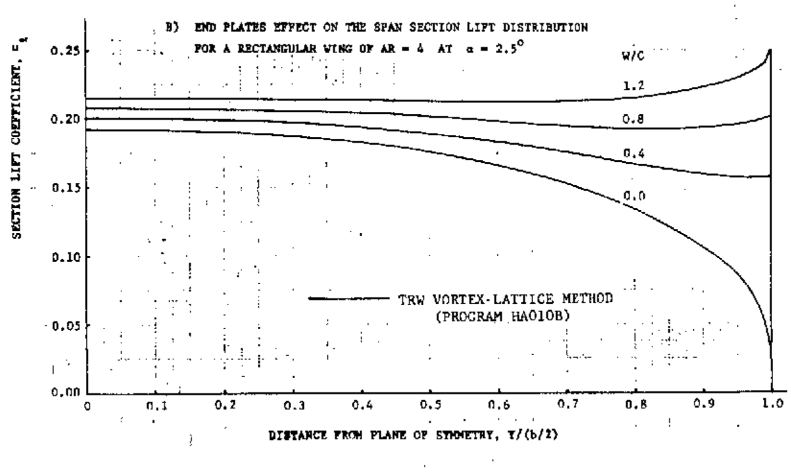


FIGURE 2.17 - WING LIFT PREDICTION COMPARISONS FOR A RECTANGULAR WING OF ASPECT RATIO = 6 WITH END PLATES

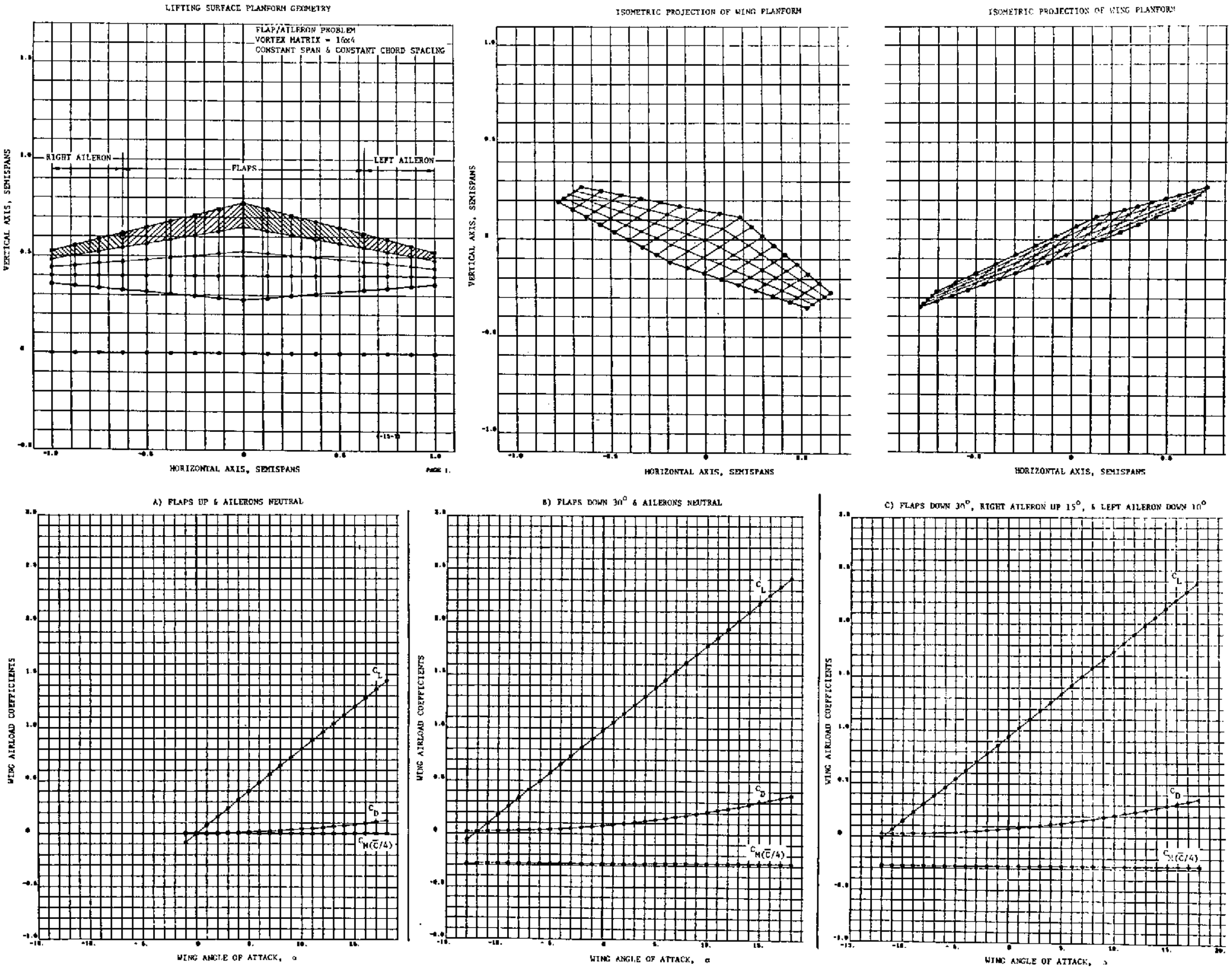


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS

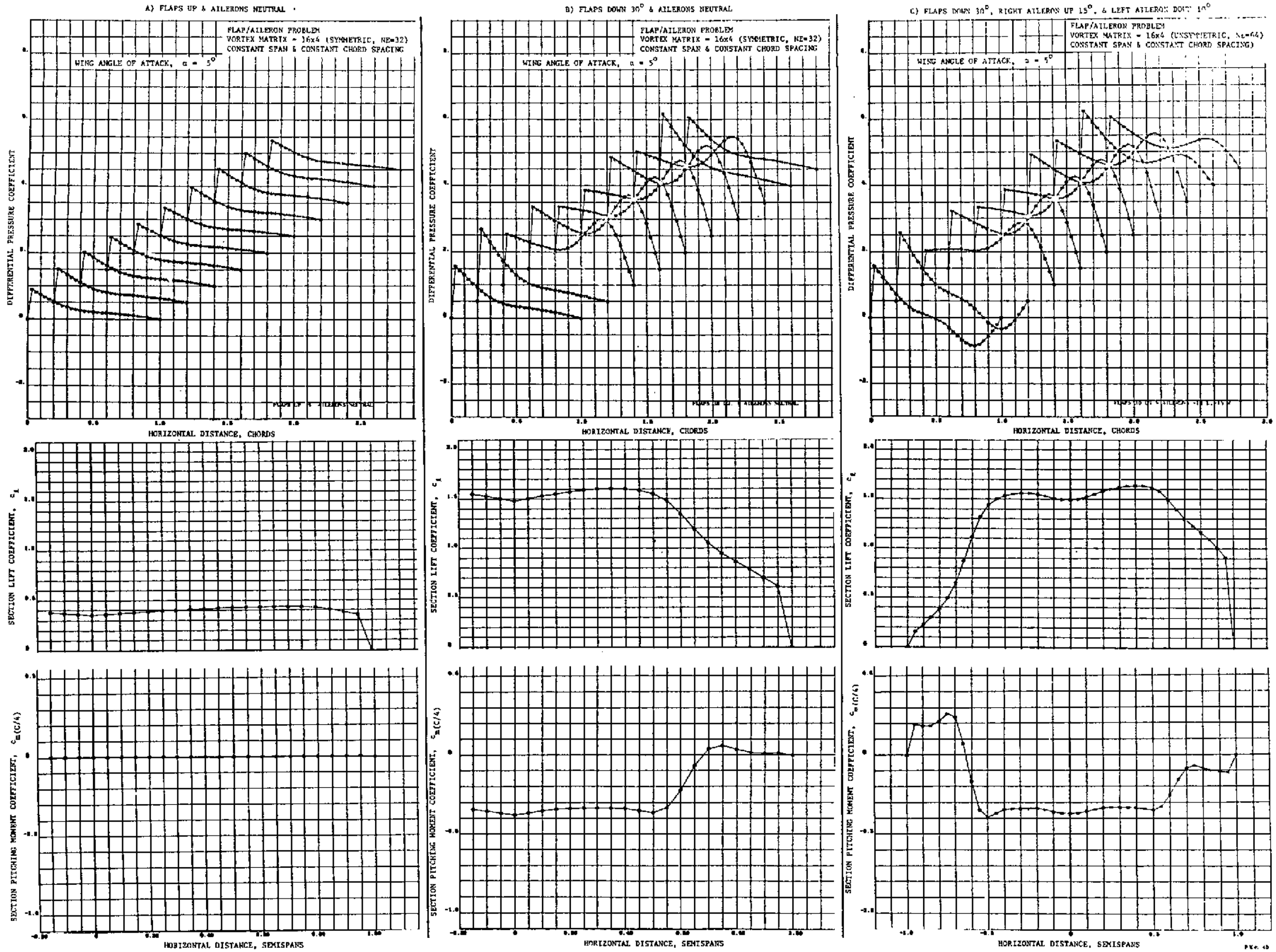


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

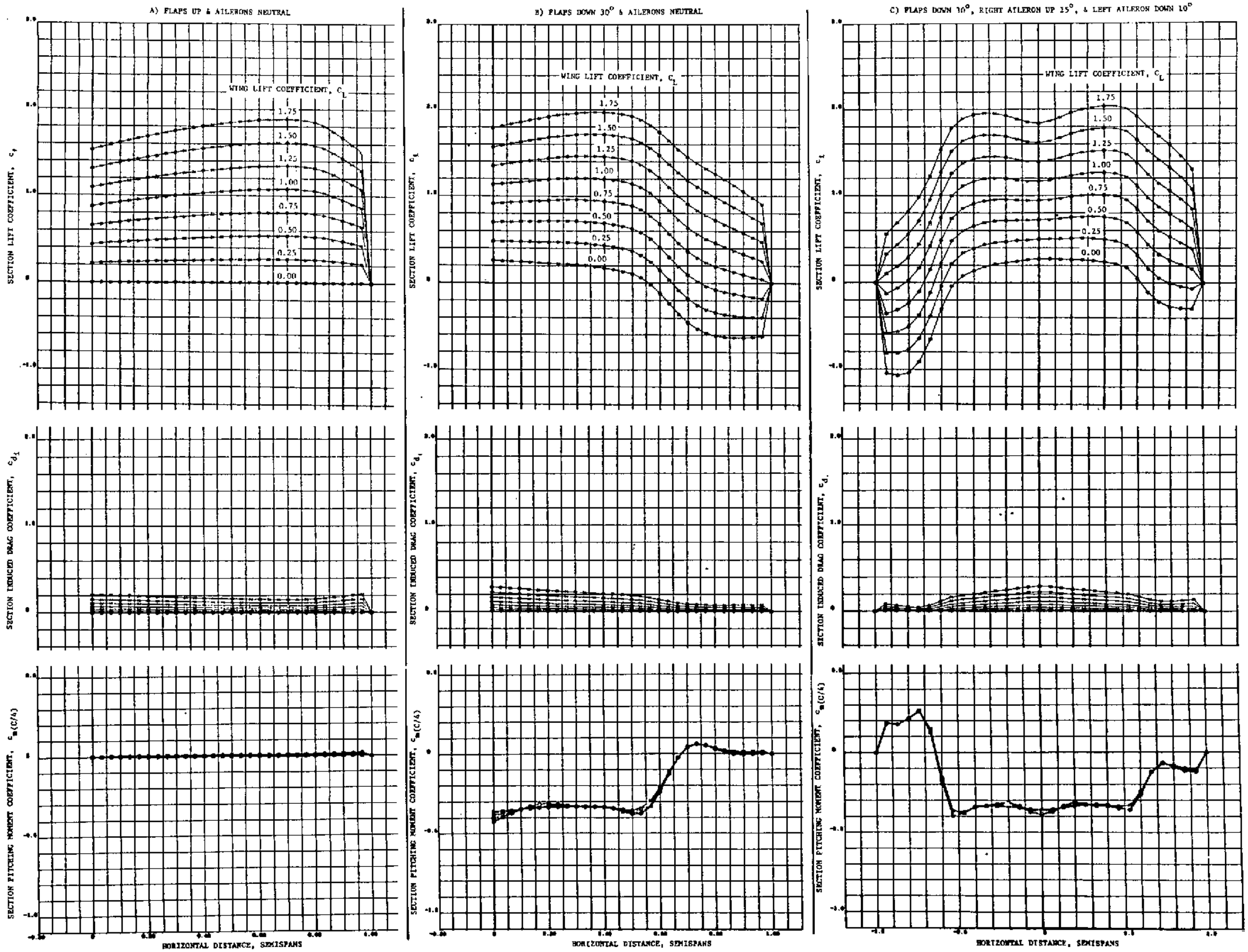


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.

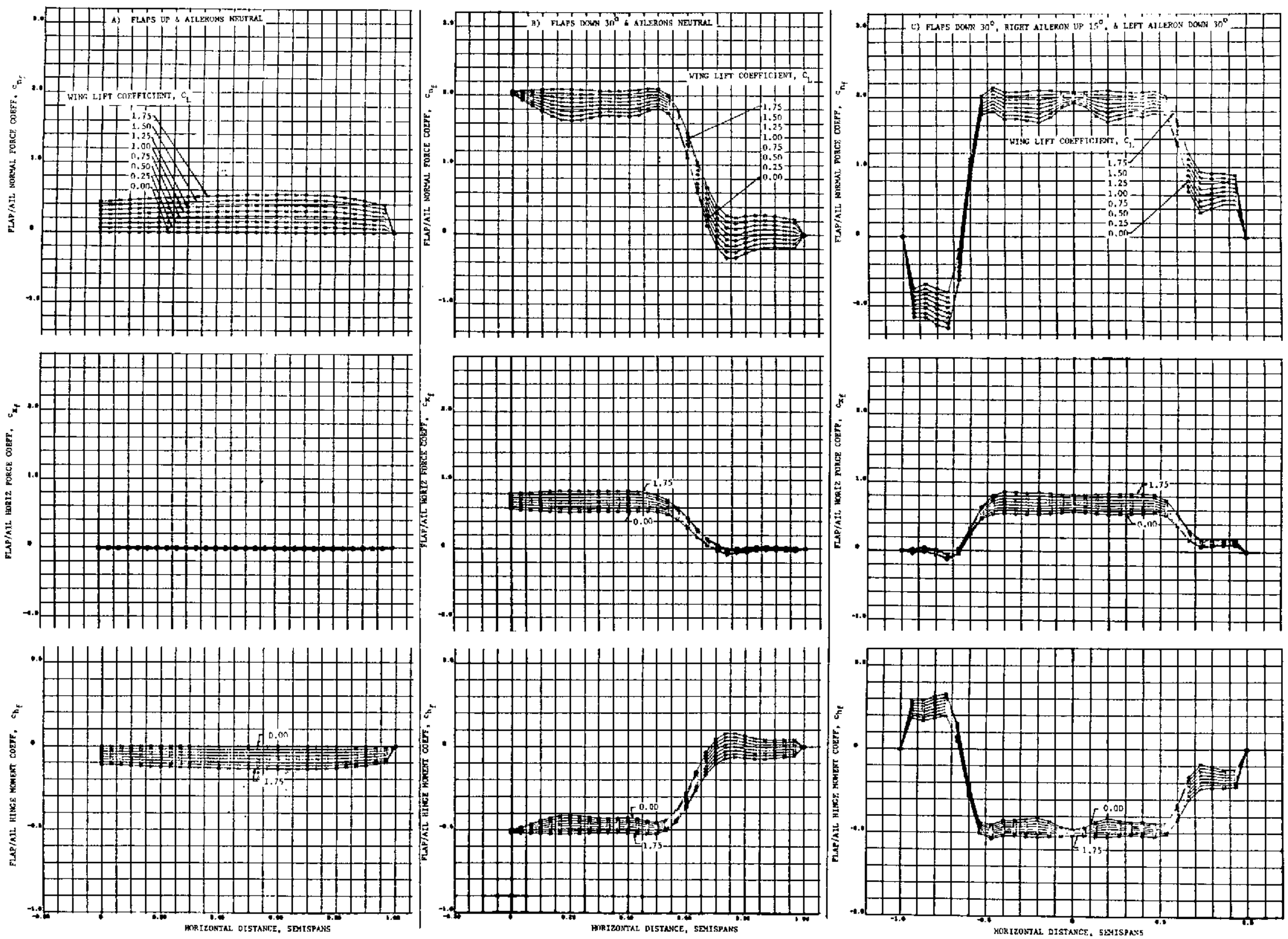
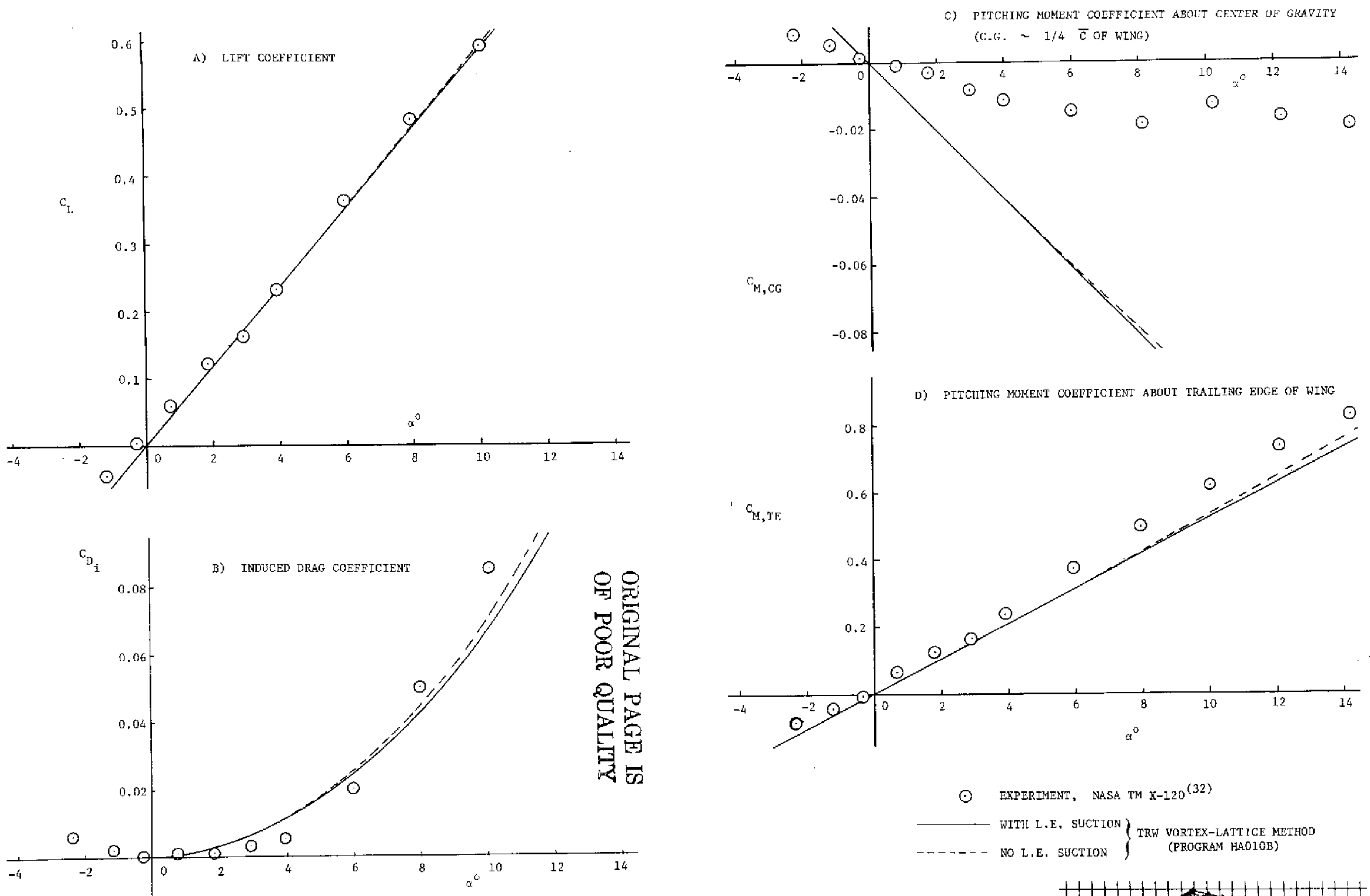


FIGURE 2.18 - AIRLOAD PREDICTIONS (PROGRAM HA010B) FOR A SELECTED STRAIGHT-TAPERED WING PLANFORM WITH GEOMETRIC TWIST DUE TO CONTROL SURFACE DEFLECTIONS, CONTINUED.



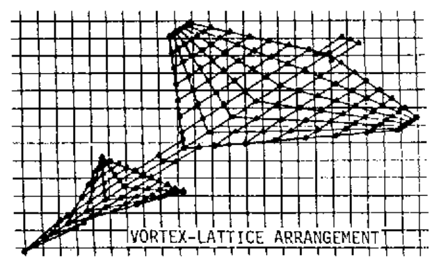


FIGURE 2.19 - MULTIPLE-SURFACE CONFIGURATION ANALYTICAL PREDICTIONS (PROGRAM HA010B) COMPARED AGAINST WIND-TUNNEL TEST DATA

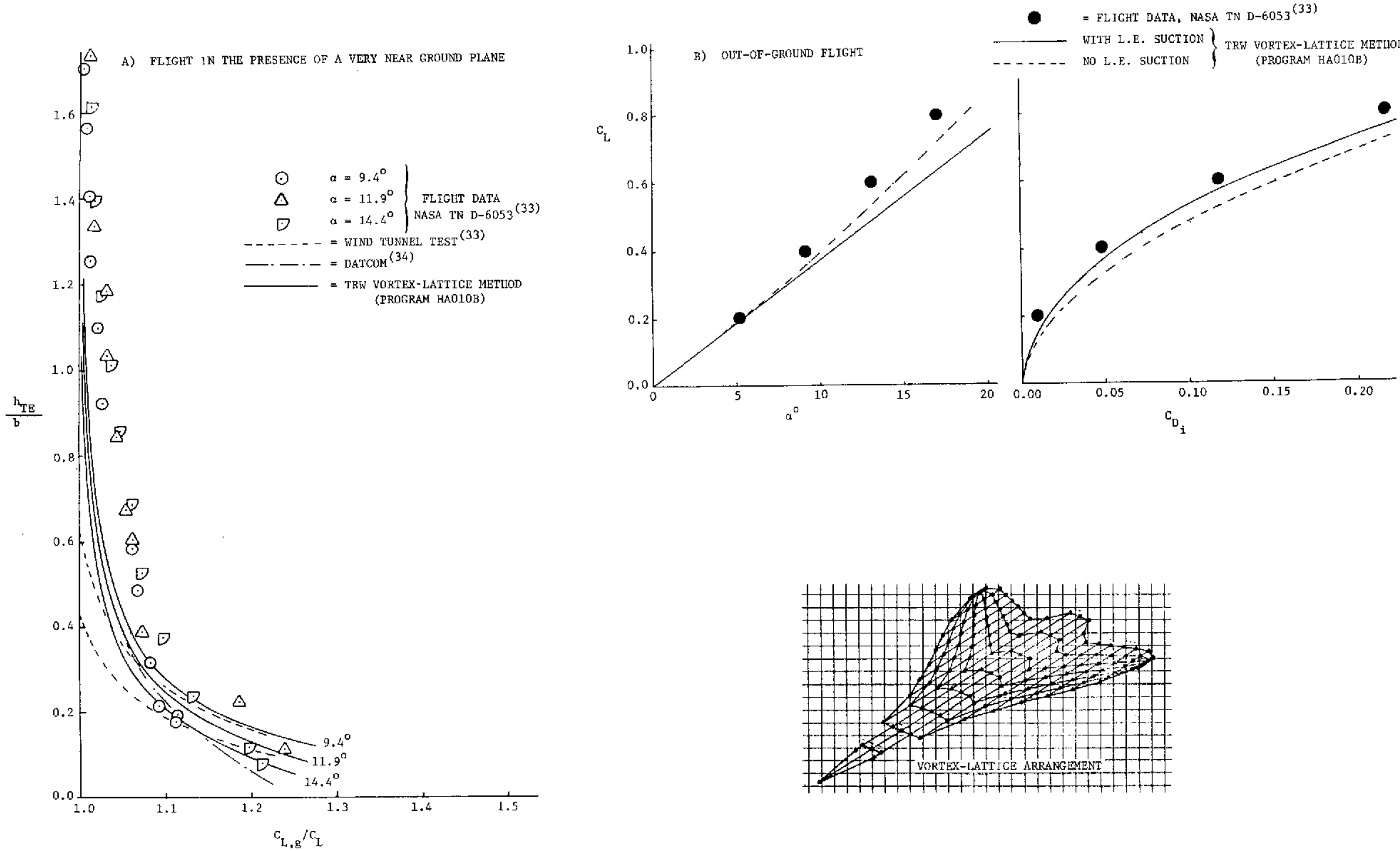


FIGURE 2.20 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE DOUGLAS F5D-1 MODIFIED AIRPLANE WITH AN OGEE WING AND COMPARISONS AGAINST FLIGHT TEST DATA

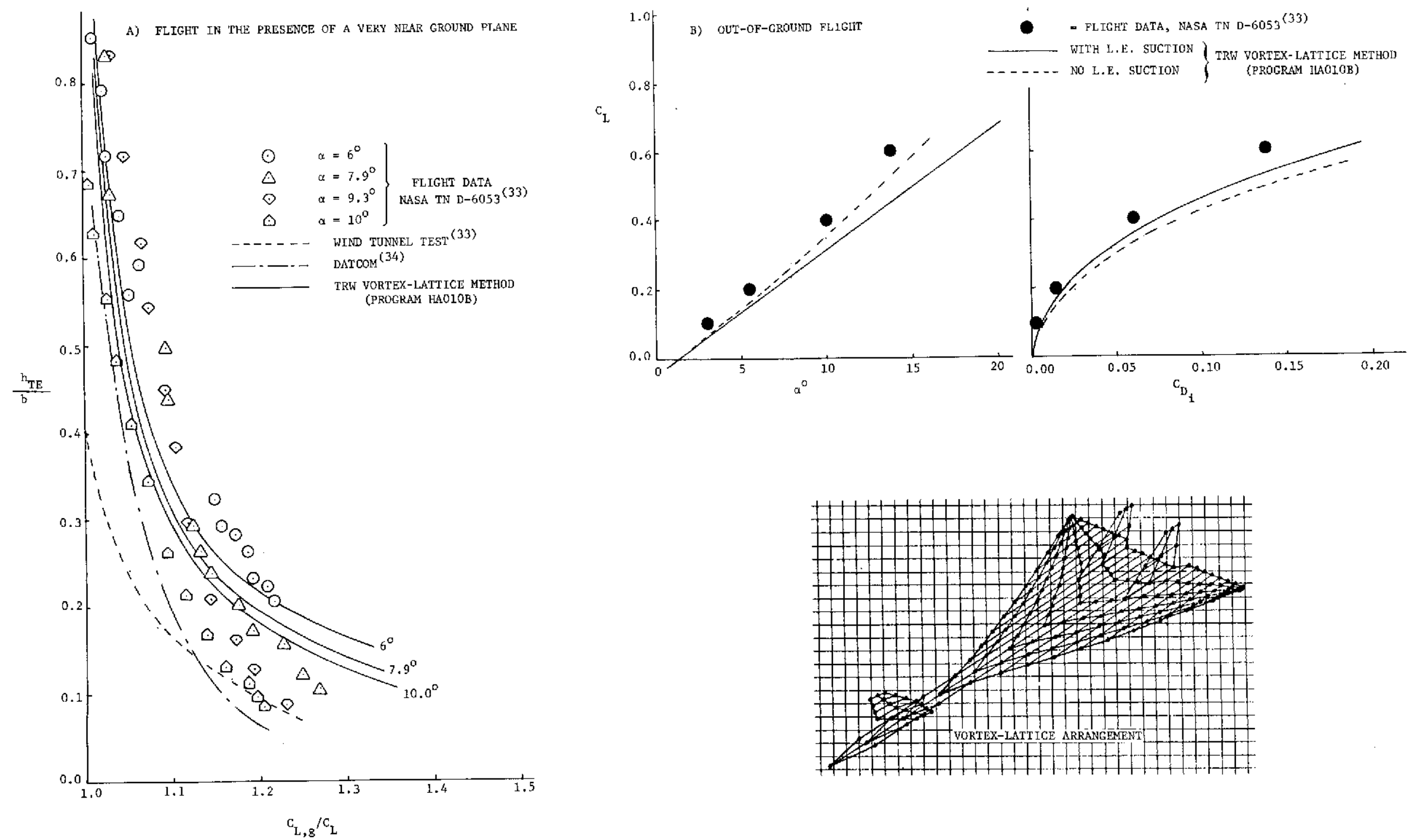


FIGURE 2.21 - MULTIPLE-SURFACE ANALYTICAL PREDICTIONS (PROGRAM HA010B) FOR THE NORTH AMERICAN XB-70 AIRPLANE AND COMPARISONS AGAINST FLIGHT TEST DATA

3.0 INPUT

3.1 General Directions for Program Input

Five separate modes of execution are permitted for the TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE). These include: (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, i.e., SQT ISURF and NSURF execution, (2) two test execution modes for determing the accuracy of the matrix inversion procedure, i.e., XQT ISURFT and NSURFT execution, and (3) one auxiliary execution mode used for obtaining Calcomp or 4060-microfilm output, i.e., XQT TRWPLT execution.

1) Main Execution Modes

Two main execution modes are permitted: XQT ISURF and SQT NSURF. These modes are used to analyze single- or multiple- lifting surface configurations respectively. Punched cards are used as the input media. NAMELIST statements and formatted statements are used exclusively. The input data is classified into groups, i.e., Group #1, Group #2, Group #3, and Group #4. A brief description of the information contained in each group and the arrangement order for input is given below:

Group No.	Function	Contents	Type of Input
#1 (START)	Execution Mode Card Mode = ISURF or NSURF	7/8 punch, space, XQT, space, mode	"A" format
#2	Job Identification (title) and Comments	1. Job Title (1 card)	"A" format
		2. Comments (3 cards)	"A" format
#3	Job execution controls and solution specifications	Namelist $INPUT	NAMELIST
#4 (END)	Job/Jobs Termination	$ENDJØBS	"A" format

2) Test Execution Modes

Two test execution modes are permitted: XQT ISURFT and SQT NSURFT. These two modes are used to determine the accuracy of the matrix inversion procedure for the ISURF and NSURF execution modes respectively. Only the execution mode card is required for input for the test execution modes, as follows:

Group No.	Function	Contents	Type of Input
#1 (ONLY)	Execution Mode Card Mode = ISURFT or NSURFT	7/8 punch, space XQT, space, mode	"A" format

3) Auxiliary Execution Mode

One auxiliary execution mode is permitted: XQT TRWPLT. This execution mode is contained in the second file of the program PCF tape and is used to generate Calcomp or 4060-microfilm output. The required input consists of the TRWPLT input instructions and a data tape. The description of the preparation of the input instructions is presented in Reference 35. The format and contents of the data tape which is generated in the execution of the main execution modes of the program is described under "Tape Output" in Section 5.3.

In preparing the program input (the main execution modes) the following conventions must be observed:

1. The first input card per case should be placed immediately following the XQT MODE card for the first case or behind the last card of the previous case for multiple case input. Blank cards between cases or input data groups should not be included in the input data deck.

2. For each case the arrangement of the input data must be ordered by groups, i.e., Group #1, Group #2, Group #3 and Group #4.

3. The last card of the input data deck is the end of jobs card (Group #4). This card must have $ENDJØBS on it only (Columns 2-9).

4. For namelist input, the first card must have the namelist on it only (i.e., $INPUT in columns 2-7).

5. For namelist input, data cards must be punched between columns 2-80. Continuation cards may be freely used by starting on the next line where the previous line left off. Every card must terminate with a comma (,). Variables that are input via NAMELIST must be dimensioned, for example:

   NSS(1) = 8,
   X(1)   = 10, 15, 15, 20, 20, 20, 30,....

3.1 General Directions for Program Input (Continued)

There is no fixed order in which the variables are to be entered. They may be grouped at the user's discretion. The following abbreviations may be used for repeating fields in a table:

X(1) = 10, 2*15, 3*20, 30, ... is equivalent to
X(1) = 10, 15, 15, 20, 20, 20, 30, ... or
X(1) = 10, X(4) = 3*20, X(2) = 2*15, ... etc.

6. For namelist input, the last card must have $END on it only (Columns 2-5).

7. Differentiation between similar looking characters: To avoid confusion due to the similarity in appearance of certain characters, the following rules should be followed:

   a. The alphabetic I is used as opposed to the numeric 1 (one).
   b. The alphabetic Z is written Ƶ as opposed to the numeric 2 (two).
   c. The alphabetic O is written Ø as opposed to the numeric 0 (zero).

The detailed input instructions and definitions of all input quantities for the program are presented in this section in the following sequence: 1) program input setup guide (Pages 3-8, 3-9), 2) program input instructions (Pages 3-10 through 3-17), AND 3) an alphabetical list of all input quantities (Pages 3-18 through 3-20). In addition, the following information that is related to the preparation of the program input is found in the following sections or figures of this report:

1) Vehicle Geometry Sign Convention:
   see Figure 3.01, Page 3-4.
2) Vortex-Lattice Arrangement Restrictions:
   see Section 3.2.
3) Input Card-Deck-Setup Examples:
   see example problems, Section 6.1.
4) Control Deck Setup:
   see Figure 7.02.
5) Execution Time:
   see Section 7.2

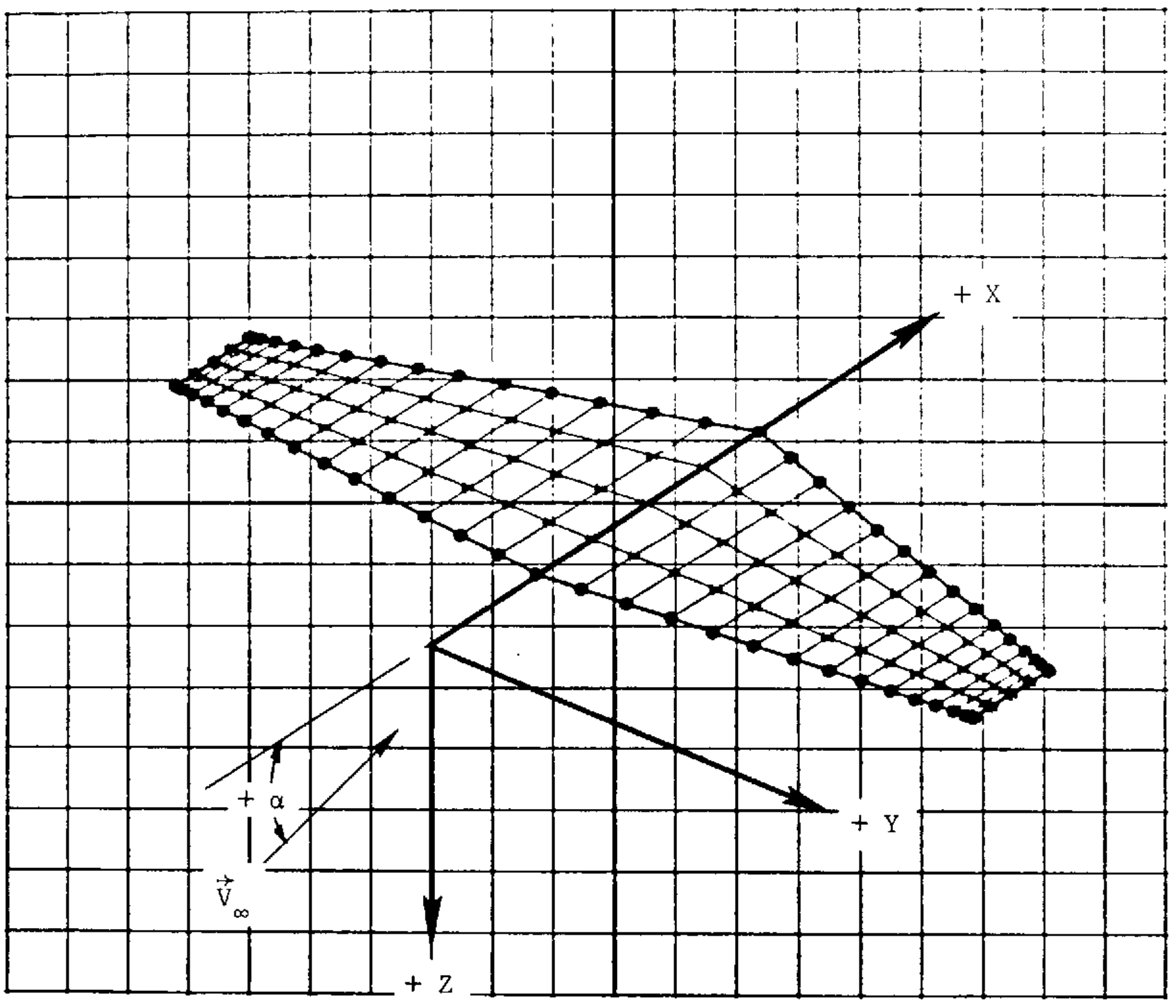


FIGURE 3.01 - LIFTING-SURFACES INPUT GEOMETRY SIGN CONVENTION (RIGHT HANDED COORDINATE SYSTEM)

3.2 Vortex-Lattice Arrangement Restrictions

The configuration of the vortex-lattice or arrangement of elemental panels that is specified in the input determines the validity of the solutions. In general, bad solutions are obtained when the number of elemental panels that determines the vortex-lattice arrangement is insufficient to properly represent the problem geometry. Other sources that lead to bad solutions are: the presence of sharp discontinuities in the lifting-surfaces geometry, unequal panel dimensions for adjacent elemental panels, and improper spacing of trailing vortices shed from forward surfaces that impinge on rear surfaces. The indicators that warn of the presence of bad solutions are:

1. The drag calculated for the sum of the total number of surfaces considered in a solution is negative. Although, negative drag is not always a good indicator for bad solutions because its magnitude is generally much smaller than the lift and therefore subject to more severe numerical roundoff errors, positive drag is unquestionably always an indicator of a good solution.

2. The calculated lift versus angle of attack curve is not smooth. The source of the errors that led to a bad solution can be determined by examining the magnitude of the calculated circulation for the vortex filaments or the spanwise lift distribution (see Figures 5.3 and 5.8).

3. The calculated values for lift and drag are out of range, i.e., the solution blew.

In the opposite side, a solution or a set of solutions may be considered to be good if by increasing the number of elemental panels or rearranging the configuration of the vortex-lattice by a small amount leads to a negligible variation of the magntude of the calculated airload coefficients. It should be noted that: "there is no shortcut or formula presently available that, if followed, will always guarantee the generation of good solutions." The program user should be aware of this fact and should follow good judgement based on experience in aerodynamics in assessing the validity of the vortex-lattice solutions that he generates.

3.2 Vortex-Lattice Arrangement Restrictions (Continued)

As a guide to engineers using the vortex-lattice analysis method for the first time, the user should adhere to the following general directions:

1. The larger the number of elemental panels used for representing a given lifting-surface configuration, the more accurate will be the solutions that will be obtained.

2. Adjacent panels should be of approximately equal size and should have approximately the same configuration, i.e., the variation in size and configuration between adjacent panels should be as small as possible (Figure 3.02[A]).

3. The width of panels in a column of one or more lifting surfaces should be exactly the same and must line up perfectly (Figure 3.02[B]). This requirement arises because of the approximate representation of the vorticity distribution on the lifting surfaces by discrete-size vortex filaments that are used in the vortex-lattice method. Note that the trailing vortices must lie equidistant to the co-location points in a row of elemental panels downstream. As a special feature of the program (TRW Vortex-Lattice Analysis Program #HA010B), the trailing vortices can be located exactly in line with a column of co-location points (Figure 3.02[C]). In this instance, the velocity induced by these vortices at the co-location points (which may be indefinite) is simply ignored.

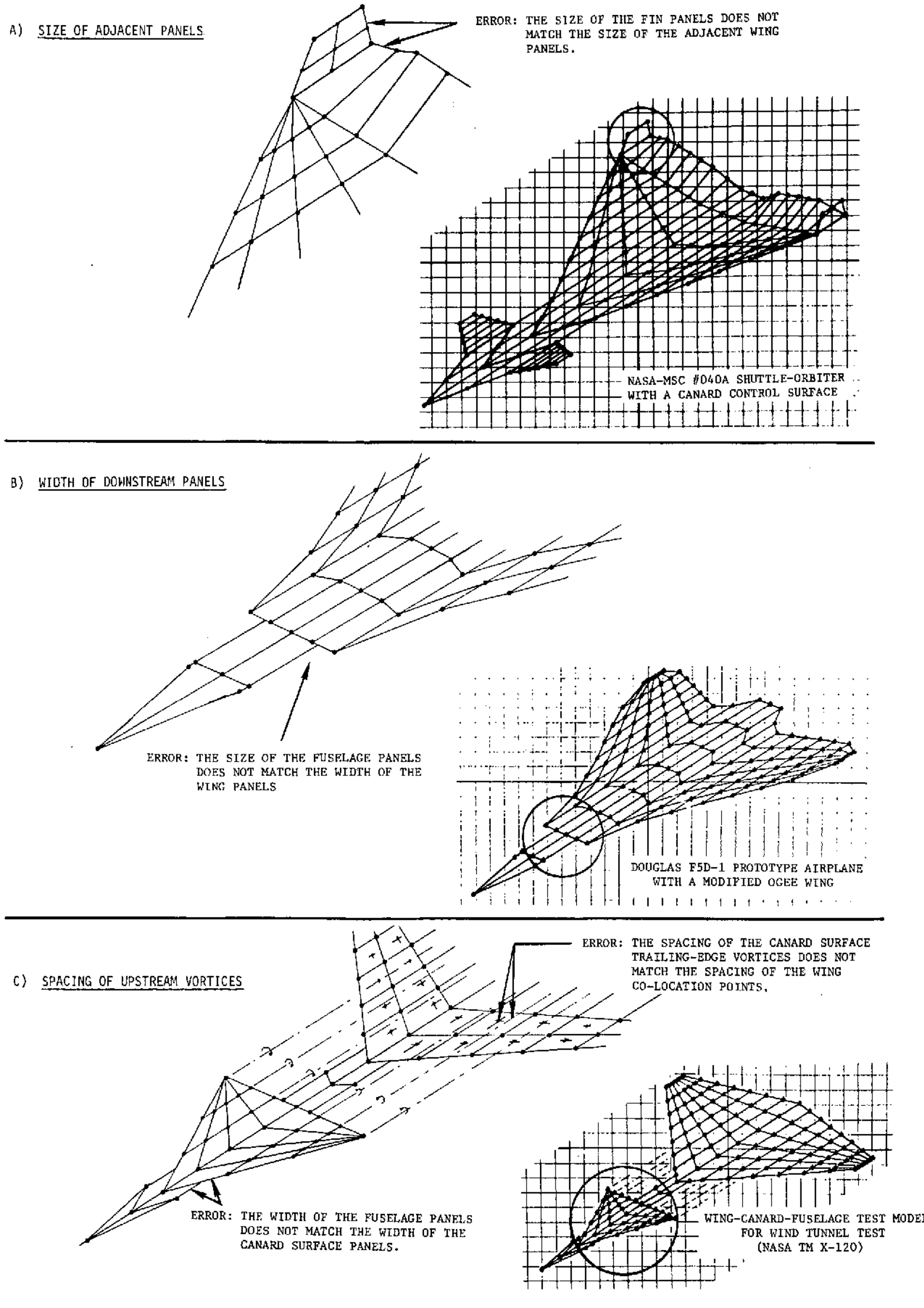


FIGURE 3.02 - ILLUSTRATION OF POOR VORTEX-LATTICE ARRANGEMENT
OVERSIZED INSERTS ARE SHOWN IN ERROR

3.3 PROGRAM INPUT SETUP GUIDE

```
∇Z RUN 54589,TRW,0001,3303A,0001,P,3,1
∇N MSG      FILE REQ.    TAPE  1  FH432  3  FSTRN  1
∇  ASG X=A10202
∇  ASG F
∇  PLT
∇  XQT CUR
   TRW X
   ERS
   IN X
   PEF X
   TRI X
   TØC
∇  XQT MØDE     (MØDE= NSURF OR ISURF)
  JØB TITLE FØR JØB 1 (1 CARD)
  CØMMENTS,REQUIRED FØR JØB 1 (3 CARDS)
  $INPUT
  NFLG,IFLG,
  KØUT,KT1,KT2,KT3,LINX,
  NWING,NFUS,NVTAIL,
  NSS,X,Y,Z,E,C,XØCR,YSPAN,
  NCS,XØC,ZØC,
  WFLAP1,WFLAP2,WFLAP3,FLAPC,TABC,FLAPDJ,TABDJ,AILDJ,
  XCG,YCG,ZCG,REFS,REFC,REFB,GSCALE,
  NJØB,ALFA,MACHN,HEIGHT,FLAPDJ,AILDJ,NSØLV,
  NJØBL,WCL,
  CØLØCP,WSMØTH,LFLAP,LDRAG,CLEANF,PMECF,CUTØF1,CUTØF2
  $END
  JOB TITLE FØR JØB 2 (1 CARD)
  $INPUT
  NAMELIST DATA
  $END
  $ENDJØBS
∇  XQT TRWPLT
   KUNIT = 8
   ICCØMP= 0
   NTRAN = 0
   IPRINT= 0
   NTYPE = 0
   NØFSCL= 1
   ISCALY = 1,1,1,1,1,1,1,1,1,1
   NXL = 24
   NXR = 24
   NYL = 24
   NYH = 24
   NPØSN1 = 600, 950
   NPØSN2 = 600, 925
   NPØSN3 = 600, 900
   NPØSN4 = 600, 50
   CHARSZ = 1,0,1,0,1,0,1,0
```

```
JOB CARD
MESSAGE CARD
PROGRAM PCF TAPE NO.
REQUIRED IF TRW PLOT
OPTION IS USED
READ-IN PROGRAM CARDS
 (LOAD THE PROGRAM)

(IF PLOT OPTION USED)

EXECUTION MODE CARD
JOB TITLE-START JOB 1
COMMENTS
START NAMELIST $INPUT
JOB-EXECUTION FLAGS
OUTPUT SPECIFICATIONS
LIFTING SURFACE TYPE
LIFTING SURFACES PLAN
AIRFOIL SECTION
FLAP-TAB-AILERONS
REFERENCE DIMENSIONS
FLIGHT ATTITUDE SPECS
LINEARIZED THEORY
OPTIONAL INPUT CONST.
END NAMELIST $INPUT
JOB TITLE-START JOB 2
START NAMELIST $INPUT
DATA FOR JOB 2
END NAMELIST $INPUT
END OF ALL JOBS
EXECUTE PLOT OPTION
PLOT EXEC. CONSTANTS
```

∇ = 7/8 PUNCH.

NOTE: THE FOLLOWING CONTROL CARDS ARE OPTIONAL FOR INPUT

∇N MSG = MESSAGE CARD (REQUIRED FOR NASA-MSC)

∇ PLT = REQUIRED FOR PLOT OUTPUT

INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION, XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN OMITTED IN THE PRESENT REPORT.

3.3 PROGRAM INPUT SETUP GUIDE (CONTINUED)

```
ANNØT1 = ID = EXAMPLE PRØB. 1 - MULTIPLE-SURFACE
ANNØT2 = ID =   CAPABILITY DEMØNSTRATION RUN
ANNØT3 = ID =              A.GØMEZ/ 5 JULY 72
ANNØT4 = ID =
 TITLE = ID = ISØMETRIC PRØJECTION ØF LIFTING SURFACES
 XLABEL = ID = HORIZØNTAL AXIS, SEMISPANS
 YLABEL = ID = VERTICAL AXIS  SEMISPANS
 XHI= 1.5
 XLØ=-1.0
 YHI= 1.5
 YLØ=-1.0
 PLØT = 2,1, 3,1, ENDLST
ENDPLT
 ANØTSV = 0
 NØADV = 1
 PLØT = 5,1, 6,1, ENDLST
ENDPLT
 NØADV = 1
 PLØT = 2,2, 3,2, ENDLST
ENDPLT
 NØADV = 1
 PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
 NØADV = 1
 PLØT = 2,1, 3,1, ENDLST
ENDPLT
 NØADV = 1
 PLØT = 5,1, 6,1, ENDLST
ENDPLT
 NØADV = 1
 PLØT = 2,2, 3,2, ENDLST
ENDPLT
 NØADV = 1
 PLØT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
∇EØF
```

ANNOTATIONS (EXAMPLE)

PLOT LABELS (EXAMPLE)

PLOT SCALE (EXAMPLE)

PLOT INSTRUCTIONS
FOR 1ST. FILE

PLOT INSTRUCTIONS
FOR 2ND. FILE...ETC.

END OF PLOTS CARD
END CARD (LAST CARD)

3.4 INPUT INSTRUCTIONS

GROUP 1 - EXECUTION MØDE CARD.

* FIVE SEPARATE EXECUTION MØDES ARE PERMITTED *

---

(1) ∇ XQT NSURF (COLUMNS 1-11) 1 TO 5 LIFTING SURFACES MAY BE CONSIDERED SIMULTANEOUSLY.

(2) ∇ XQT ISURF (COLUMNS 1-11) ONLY 1 LIFTING SURFACE MAY BE CONSIDERED WITH OR WITHOUT LINEARIZED LIFT OPTION.

(3) ∇ XQT NSURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT NSURF MODE.

(4) ∇ XQT ISURFT (COLUMNS 1-12) MATRIX INVERSION TEST FOR XQT ISURF MODE.

(5) ∇ XQT TRWPLT (COLUMNS 1-12) PLOT OPTION(REFERENCE 35)

GROUP 2 - JOB IDENTIFICATION (TITLE) AND COMMENTS.

* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES *

```
CARD 1            FORMAT(13A6,A2)     (TITLE(I),I=1,14)
CARDS 2,3,4       FORMAT((13A6,A2))   (CØMTS(I),I=1,42)   (JOB 1 ONLY)
```

GROUP 3 - VORTEX-LATTICE ANALYTICAL SOLUTION SPECIFICATIONS.

* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES *

** NAMELIST INPUT FORMAT **

```
     NAMELIST/INPUT/ NFLG  ,IFLG  ,KØUT  ,KT1   ,KT2   ,KT3   ,LINX
   * ,NWING ,NFUS  ,NVTAIL,NSS   ,X     ,Y     ,Z     ,E     ,C
   * ,XØCR  ,YSPAN ,NCS   ,XØC   ,ZØC   ,WFLAP1,WFLAP2,WFLAP3,FLAPC
   * ,TABC  ,FLAPDJ,TABDJ ,AILDJ ,XCG   ,YCG   ,ZCG   ,REFS  ,REFC
   * ,REFB  ,GSCALE,NJØB  ,ALFA  ,MACHN ,HEIGHT,FLAPDJ,AILDJ ,NSØLV
   * ,NJØBL ,WCL   ,CØLØCP,WSMØTH,LFLAP ,LDRAG ,CLEANF,PMECF ,CUTØF1
   * ,CUTOF2
```

** JOB-EXECUTION FLAGS **

(1) NFLAG REQUIRED FOR NSURF EXECUTION MODE.

(NFLG(N),N=1,M) NUMBER OF SPANWISE VORTEX-LATTICE ELEMENTS ASSIGNED TO THE N SURFACE, WHERE M.LE.5.

(NFLG(N+5),N=1,M) NUMBER OF CHORDWISE VORTEX-LATTICE ELEMENTS ASSIGNED TO THE N SURFACE.

(NFLG(N+10),N=1,M) NUMBER OF CHORDWISE DISCONTINUITIES ASSIGNED TO THE N SURFACE, WHERE,

NFLG(N+10).EQ.0 NO FLAPS AND/OR AILERONS,
NFLG(N+10).GE.1 WITH FLAPS AND/OR AILERONS,
NFLG(N+10).EQ.2 WITH TAB SURFACE.

NFLG(16) = 0 ZOC(K,J) INPUT IS DIMENSIONLESS (NORMALIZED BY C(J)).
= 1 ZOC(K,J) INPUT IS DIMENSIONED USING THE SAME UNITS AS THE WING PLANFORM SPECIFICATIONS (E.G., Y(J),X(J),ETC.)

NFLG(17) = 0 NO EFFECT (OUT-OF-GROUND).
= 1 GROUND EFFECTS,I.E.,FLIGHT IN THE PRESENCE OF A GROUND PLANE ARE CALCULATED.

NFLG(18) = 0 NO EFFECT.
= 1 ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE SOLUTIONS, THIS OPTION NOT OPERATIONAL AT PRESENT.

NFLG(19) = 0 NO EFFECT.
= 1 CALCOMP OR MICROFILM PLOT DATA TAPE IS GENERATED.

NFLG(20) = ND PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT, USED AS FOLLOWS,

ND.GE.0 = SHORT-PRINT OUTPUT, I.E., NAMELIST $INPUT, SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND, SECTION AND SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS ARE OUTPUT.

ND.GE.1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.

ND.GE.2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED VELOCITY ARE OUTPUT

ND.GE.5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED VELOCITY INCREMENTS ARE OUTPUT.

ND.GE.8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELISTS $DBUG1, $DBUG2, AND $DBUG3 ARE OUTPUT.

ND.GT.15,AND,NFLG(17).GE.1 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELIST $REFLEX IS OUTPUT.

(2) IFLAG REQUIRED FOR ISURF EXECUTION MODE.

IFLG(1) = 0 SYMMETRIC LIFT LOADING, NOT REQUIRED FOR INPUT,VALUES
= 1 UNSYMMETRIC LIFT LOADING. ARE ASSIGNED IN EXECUTION

IFLG(2) = NSD NUMBER OF SPAN DISCONTINUITIES, NSD= 0,1,2,3,OR 4, REQUIRED INPUT IF IFLG(4).NE.0.

IFLG(3) = NSE NUMBER OF SPAN VORTEX-LATTICE ELEMENTS, NSE.LE.NSEMAX, WHERE NSEMAX=41 AND 21 FOR SYMMETRIC AND UNSYMMETRIC LIFT LOADING RESPECTIVELY.

IFLG(4) = 0 EQUAL SPAN-SPACING FOR VORTEX-LATTICE ELEMENTS.
= 1 COSINE (VARIABLE) SPAN SPACING OF VORTEX-LATTICE ELEMENTS.
= 2 SPAN-SPACING OF VORTEX-LATTICE ELEMENTS IS TO BE ASSIGNED IN THE INPUT, (YSPAN(N),N=1,NSE).

IFLG(5) = NCD — NUMBER OF CHORD DISCONTINUITIES, WHERE NCD=0 AND NCD=1 MUST BE ASSIGNED TO UNFLAPPED AND FLAPPED WING SURFACES RESPECTIVELY.

IFLG(6) = NCE — NUMBER OF CHORD VORTEX-LATTICE ELEMENTS, NCE.LE.NCEMAX, WHERE NCEMAX=9, AND NCE.GE.2 FOR FLAPPED SURFACES.

IFLG(7) = 0 — EQUAL CHORD-SPACING FOR VORTEX-LATTICE ELEMENTS,
= 1 — COSINE (VARIABLE) CHORD SPACING OF VORTEX-LATTICE ELEMENTS.

IFLG(8) = 0 — NO EFFECT.
= 1 — ARRAYS OF SOLUTIONS USING LIFTING LINE THEORY ARE CALCULATED FROM A PAIR OF EXACT VORTEX-LATTICE SOLUTIONS.

IFLG(9) = 0 — NO EFFECT.
= 1 — GROUND EFFECTS,I.E.,FLIGHT IN THE PRESENCE OF A GROUND PLANE ARE CALCULATED.

IFLG(10) = ND — PRINT-OUTPUT CONTROL EFFICIENCY FLAG ASSIGNMENT, USED AS FOLLOWS,

ND.GE.0 = SHORT-PRINT OUTPUT, I.E., NAMELIST $INPUT, SURFACES GEOMETRY, AIRFOIL MEAN-CAMBER, AND, SECTION AND SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS ARE OUTPUT.

ND.GE.1 = VORTEX-LATTICE GEOMETRY DETAIL IS OUTPUT.

ND.GE.2 = VORTEX-LATTICE ELEMENTAL LIFT AND INDUCED VELOCITY ARE OUTPUT

ND.GE.5 = VORTEX-LATTICE GEOMETRY DETAIL, AND INDUCED VELOCITY INCREMENTS ARE OUTPUT.

ND.GE.8 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELISTS $DBUG1, $DBUG2, AND $DBUG3 ARE OUTPUT.

ND.GT.15.AND.IFLG(9).GE.1 = DEBUG OUTPUT FOR PROGRAM CHECK/DEVELOPMENT, I.E., NAMELIST $REFLEX IS OUTPUT.

IFLG(11)= 0 — NO EFFECT.
= 1 — OUTPUT SOLUTIONS FOR CHORDWISE AND SPANWISE SECTION AIRLOAD COEFFICIENTS.

IFLG(12)= 0 — NO EFFECT.
= 1 — OUTPUT SURFACE PLANFORM GEOMETRY ON CALCOMP/MICROFILM PLOT TAPE.

IFLG(13)= 0 — NO EFFECT.
= 1 — OUTPUT CHORD AND SPAN SECTION AIRLOAD COEFFICIENTS ON CALCOMP/MICROFILM PLOT TAPE.

IFLG(14)= 0 — NO EFFECT.
OUTPUT LINEARIZED SOLUTION OF AIRLOAD COEFFICIENTS ON CALCOMP/MICROFILM PLOT TAPE.

IFLG(15) — NOT A REQUIRED INPUT, VALUE ASSIGNED IN EXECUTION.

** OUTPUT SPECIFICATIONS **

KØUT (=6 IF OMITTED) PRINT BCD OUTPUT PHYSICAL UNIT ASSIGNMENT.

KT1 (=1 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

KT2 (=8, ASG LOGICAL UNIT F, IF OMITTED) CALCOMP/MICROFILM DRUM OR TAPE PHYSICAL UNIT ASSIGNMENT.

KT3 (=3 IF OMITTED) SCRATCH/WORK PHYSICAL UNIT ASSIGNMENT.

LINX (=56 IF OMITTED) MAXIMUM NUMBER OF LINES PER PAGE FOR PRINTED OUTPUT.

** SURFACE TYPE CLASSIFICATIONS **
* OMIT FOR XQT ISURF EXECUTION MODE *

NWING (=1 IF OMITTED) NUMBER OF SYMMETRIC LIFTING SURFACES, E.G., WING SURFACES, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING, (N.LE.5)

NFUS (=0 IF OMITTED) NUMBER OF ANTISYMMETRIC LIFTING SURFACES, E.G., VERTICAL SURFACE/S ASSIGNED TO REPRESENT A FUSELAGE OR A VERTICAL FIN, THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS, (N.LE.5)

NVTAIL (=0 IF OMITTED) NUMBER OF ANTISYMMETRIC LIFTING SURFACES, E.G., VERTICAL SURFACE/S ASSIGNED TO REPRESENT A VERTICAL FIN, TWIN FINS, END PLATES, ETC., THAT MUST BE ORDERED AS FOLLOWS,

N = 1,2,3,...,NWING+NFUS+IABS(NVTAIL), (N.LE.5)

NVTAIL MAY BE ENTERED AS A POSITIVE OR A NEGATIVE INTEGER IN ORDER TO SPECIFY SYMMETRY ABOUT THE PLANE Y=0, I.E.,

+ INTEGER = ANTISYMMETRIC SURFACE, E.G. A SINGLE FIN,
- INTEGER = SYMMETRIC SURFACE, E.G. TWIN FINS,

NS (NOT AN INPUT QUANTITY) TOTAL NUMBER OF SURFACES TO BE CONSIDERED THAT IS CALCULATED INTERNALLY USING THE FOLLOWING FORMULA

NS= NWING + NFUS + IABS(NVTAIL) (NS.LE.5)

N (NOT AN INPUT QUANTITY) ORDER NUMBER ASSIGNED TO NTH.SURFACE.

** SURFACE PLANFORM SPECIFICATIONS **
* NS= 1 FOR XQT ISURF EXECUTION MODE *

(NSS(N),N=1,NS) STORAGE ORDER NUMBER ALLOCATED TO THE LAST SPAN STATION ENTRY FOR THE N LIFTING SURFACE, WHERE,

NSS(1) = NUMBER OF SPAN STATION ENTRIES ALLOCATED TO THE FIRST SURFACE,

NSS(N)-NSS(M) = NUMBER OF SPAN STATION ENTRIES ALLOCATED TO THE N SURFACE, IN ORDER, N=1,2,..,M,N,..,NS.

(X(J),J=1,NSS(NS)) LONGITUDINAL COORDINATE OF JTH. POINT OF THE REFERENCE LOFT LINE, E.G., FUSELAGE STATIONS.

(Y(J),J=1,NSS(NS)) SPANWISE COORDINATE OF JTH. POINT OF THE REFERENCE LOFT LINE, E.G., WING STATIONS.

(Z(J),J=1,NSS(NS)) VERTICAL COORDINATE OF JTH. POINT OF THE REFERENCE LOFT LINE, E.G, WATERLINE STATIONS.

(E(J),J=1,NSS(NS)) ANGLE OF TWIST OF CHORD PLANE RELATIVE TO THE LONGITUDINAL COORDINATE FOR THE AIRFOIL SECTION AT THE JTH.POINT OF THE REFERENCE LOFT LINE.

(C(J),J=1,NSS(NS)) CHORD LENGTH DIMENSION OF THE AIRFOIL SECTION AT THE JTH.POINT OF THE REFERENCE LOFT LINE.

(XØCR(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE FOR THE JTH.POINT.

(XØCR(N),N=1) (OMIT FOR XQT NSURF) THE RELATIVE LOCATION OF THE REFERENCE LOFT LINE IN CHORDS MEASURED FROM THE LEADING EDGE ASSUMED CONSTANT FOR THE NTH.SURFACE.

(YSPAN(N),N=1,NSE+1) (REQUIRED IF(IFLG.GE.2)) SPAN STATIONS THAT BOUND THE VORTEX MATRIX ELEMENTS.

** AIRFOIL SECTION (CAMBER) SPECIFICATIONS **

(NCS(N),N=1,NS) NUMBER OF CHORD STATIONS ALLOCATED FOR DESCRIBING THE AIRFOIL SECTION MEAN CAMBER LINE FOR THE NTH, LIFTING SURFACE, WHERE,

NCS(N).GE.2. AND/OR NCS(N).LE.10.

((XØC(K,N),K=1,NCS(N)),N=1,NS) CHORD STATION OF AIRFOIL SECTION, I.E., DISTANCE FROM THE LEADING EDGE MEASURED IN CHORDS ALONG THE AIRFOIL SECTION CHORD PLANE.

((ZØC(K,J),K=1,NCS(N)), J=1,NSS(NS),AND. N=1,NS) AIRFOIL SECTION MEAN CAMBER SPECIFICATION, I.E., NORMAL DISTANCE TO THE MEAN CAMBER LINE MEASURED IN CHORDS FROM THE AIRFOIL SECTION CHORD PLANE, CORRESPONDING TO THE JTH, POINT OF THE REFERENCE LOFT LINE.

** CONTROL SURFACE GEOMETRY SPECIFICATIONS **

(WFLAP1(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE INNER BOUNDARY OF THE FLAP SURFACE/S, WHERE,

IF(WFLAP1(N).EQ.0.0) FLAP SURFACE IS CONTINUOUS AT THE CENTER SPAN SECTION,

IF(WFLAP1(N).LE.1.0) DISTANCE MEASURED IN SPANS,

(WFLAP2(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE FLAP OR THE INNER BOUNDARY OF THE AILERON SURFACES, WHERE,

IF(WFLAP2(N).LE.1.0) DISTANCE MEASURED IN SPANS,

(WFLAP3(N),N=1,NS) SPAN DISTANCE FROM PLANE OF SYMMETRY TO THE OUTER BOUNDARY OF THE AILERON SURFACES, WHERE,

IF(WFLAP3(N).LE.1.0) DISTANCE MEASURED IN SPANS,

(FLAPC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE JTH,POINT OF THE REFERECE LOFT LINE, WHERE,

IF(FLAPC(J).LT.1.0) FLAPC(J) IS NORMALIZED BY C(J),

(FLAPC(N),N=1,NS) (OMIT FOR XQT NSURF) FLAP/S AND/OR AILERONS CHORD LENGTH FOR THE NTH.SURFACE, WHERE,

IF(FLAPC(N).LT.1.0) FLAPC(N) IS NORMALIZED BY C(J),

(TABC(J),J=1,NSS(NS)) (OMIT FOR XQT ISURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE JTH,POINT OF THE REFERENCE LOFT LINE, WHERE,

	IF(TABC(J).LT.1) TABC(J) IS NORMALIZED BY C(J).
(TABC(N),N=1,NS)	(OMIT FOR XQT NSURF) TAB OR AUXILIARY ELEVONS CHORD LENGTH FOR THE NTH,SURFACE, WHERE,
	IF(TABC(N).LT.1) TABC(N) IS NORMALIZED BY C(J).
(FLAPDJ(N),N=1,NS)	(OMIT FOR XQT ISURF) FLAP DEFLECTION (DEGREES), WHERE,
	IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN, IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP.
(TABDJ(N),N=1,NS)	(OMIT FOR XQT ISURF) TAB DEFLECTION (DEGREES), WHERE,
	IF(TABDJ(N).GT.0) TAB DEFLECTION IS DOWN, IF(TABDJ(N).LT.0) TAB DEFLECTION IS UP.
((AILDJ(L,N),L=1,2), N=1,NS)	(OMIT FOR XQT ISURF) AILERON DEFLECTIONS (DEGREES), WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES RIGHT AILERON, AND,

	IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,
	IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,
	IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTISYMMETRIC LIFT,

** REFERENCE DIMENSIONS **
* OMIT FOR XQT ISURF EXECUTION MODE *

XCG	(=0.0 IF OMITTED) LONGITUDINAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.
YCG	(=0.0 IF OMITTED) SPANWISE LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.
ZCG	(=0.0 IF OMITTED) VERTICAL LOCATION OF THE CENTER OF GRAVITY MEASURED FROM THE LOFT COORDINATE SYSTEM ORIGIN.
REFS	(=1000.0 IF OMITTED) REFERENCE AREA FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.
REFC	(=100.0 IF OMITTED) REFERENCE CHORD FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.
REFB	(=100.0 IF OMITTED) REFERENCE SPAN FOR NORMALIZING THE CENTER AERODYNAMIC FORCE AND MOMENT COEFFICIENTS.
GSCALE	(=1.0 IF OMITTED) GEOMETRY SCALING FACTOR THAT IS USED AS FOLLOWS, ALL DIMENSIONAL PHYSICAL QUANTITIES ARE MULTIPLIED BY GSCALE BEFORE EXECUTION, WITH THE EXCEPTION OF HEIGHT(N), THUS CHANGING THE SCALE OF THE INPUT GEOMETRY TO ANY DESIRED UNITS, AND, GSCALE IS SET EQUAL TO UNITY BEFORE THE NEXT JOB-RUN.

** FLIGHT ATTITUDE AND MULTIPLE-SURFACE SOLUTION SPECIFICATIONS **

NJØB	NUMBER OF SEPARATE FLIGHT CONDITIONS OR JOB RUNS TO BE CALCULATED.
(ALFA(N),N=1,NJØB)	FLIGHT ATTITUDE ANGLE OF ATTACK (DEG.), I.E., ANGLE BETWEEN FREE STREAM VELOCITY VECTOR AND THE LOFT COORDINATE SYSTEM LONGITUDINAL AXIS (X-AXIS).
(MACHN(N),N=1,NJØB)	FLIGHT MACH NUMBER BASED ON FREE STREAM SPEED OF SOUND.
(HEIGHT(N),N=1,NJØB)	ALTITUDE MEASURED FROM THE GROUND PLANE TO THE VEHICLE LOFT COORDINATE SYSTEM ORIGIN (X=Y=Z=0),

```
(FLAPDJ(N),N=1,NJØB)     (OMIT FOR XQT NSURF) FLAP DEFLECTION (DEGREES), WHERE,

                            IF(FLAPDJ(N).GT.0) FLAP DEFLECTION IS DOWN,
                            IF(FLAPDJ(N).LT.0) FLAP DEFLECTION IS UP,

((AILDJ(L,N),L=1,2),     (OMIT FOR XQT NSURF) AILERON DEFLECTIONS (DEGREES),
 N=1,NJØB)                WHERE, L=1 DENOTES LEFT AILERON AND L=2 DENOTES
                          RIGHT AILERON, AND,

                            IF(AILDJ(L,N).GT.0) AILERON DEFLECTION IS DOWN,
                            IF(AILDJ(L,N).LT.0) AILERON DEFLECTION IS UP,
                            IF(AILDJ(1,N).NE.AILDJ(2,N)) ANTISYMMETRIC LIFT,

((NSØLV(M,N),M=1,2)      (OMIT FOR XQT ISURF) MULTIPLE SURFACE SOLUTION
  N=1,...,5)              SPECIFICATION FLAG, TO BE USED AS ILLUSTRATED IN
                          THE FOLLOWING EXAMPLE,

                             NSØLV= 1,1, 2,2, 1,2, 1,3, 2*0,

                          MULTIPLE-SURFACE INDEPENDENT SOLUTIONS ARE OBTAINED
                          FOR THE FOLLOWING COMBINATIONS,

                             SURFACE 1 TO SURFACE 1 =  SURFACE 1 ONLY,
                             SURFACE 2 TO SURFACE 2 =  SURFACE 2 ONLY,
                             SURFACE 1 TO SURFACE 2 =  SURFACES 1 AND 2 ONLY
                             SURFACE 1 TO SURFACE 3 =  SURFACES 1 THROUGH 3,


** LINEARIZED THEORY LIFTING-LINE SOLUTIONS OPTION **
 * OMIT FOR XQT NSURF EXECUTION OPTION *

   NJØBL                  (=0 IF OMITTED) NUMBER OF LINEARIZED LIFTING LINE
                          SOLUTIONS TO BE EXECUTED.

   WCL(1) = 0 OR 1        (REQUIRED INPUT IF IFLG(8).GE.1) LINEARIZED SOLUTION
                          SPECIFICATION THAT IS USED AS FOLLOWS,

                            IF(WCL(1).EQ.0)  ALFA(J),J=1,NJOBL ARRAY CALCULATED,
                            IF(WCL(1).EQ.1)  WCL(J+1),J=1,NJOBL ARRAY CALCULATED

 (WCL(J+1),J=1,NJØBL)     (REQUIRED INPUT IF(IFLG(8).GE.1.AND.WCL(1).GE.1)
                          WING LIFT COEFFICIENT


** OPTIONAL-INPUT EXECUTION CONSTANTS **

   CØLØCP     (=0.75 IF OMITTED) COLOCATION POINT OR CONTROL POINT LOCATION
              SPECIFICATION FOR THE VORTEX LATTICE ELEMENTS, A RANGE OF
              0.75-0.83 IS GENERALLY USED.

   WSMØTH     (=0.10 IF OMITTED) FLAP AND/OR AILERON DISCONTINUITY COSINE-
              SMOOTHING OPTION, WHERE,

                IF(WSMØTH.LT.1.0) WSMOTH INPUT IN SPAN UNITS,
                IF(WSMØTH.GT.1.0) WSMOTH INPUT IN PHYSICAL UNITS,

   LFLAP      (=0 IF OMITTED) FLAPPED SURFACE BOUNDARY CONDITIONS FLAG, USED
              AS FOLLOWS,

                IF(LFLAP.EQ.0) EXACT GEOMETRY OF FLAP OR AILERON IS USED IN
                               EVALUATING BOUNDARY CONDITIONS,

                IF(LFLAP.EQ.1) LINEARIZED-FIRST ORDER THEORY IS USED IN
                               EVALUATING BOUNDARY CONDITIONS FOR THE FLAP
                               OR AILERON SURFACES,
```

LDRAG (=0 IF OMITTED) CALCULATION OF INDUCED DRAG FLAG, USED AS FOLLOWS,

IF(LDRAG.EQ.0) VORTEX LATTICE SOLUTION IS OUTPUT,
IF(LDRAG.EQ.1) LIFTING-LINE THEORY IS USED IN CALCULATING THE INDUCED DRAG (XQT ISURF ONLY).

CLEANF (=0.0035 IF OMITTED) SURFACE SKIN FRICTION AERODYNAMIC CLEANNESS FACTOR (= SF/AW) USED FOR XQT ISURF EXECUTION MODE ONLY.

PMECF (=1.0 IF OMITTED) PITCHING MOMENT EMPIRICAL CORRECTION FACTOR USED FOR XQT ISURF EXECUTION MODE, IF(PMECF.EQ.1), THEORETICAL SOLUTION IS OUTPUT.

CUTØF1 (=0.0001 IF OMITTED) CUTOFF LIMIT FOR RADIUS TO A VORTEX FILAMENT ELEMENT FROM A FLOW-FIELD POINT NORMALIZED BY THE VORTEX FILAMENT SPAN.

CUTØF2 (=0.0029 IF OMITTED) CUTOFF LIMIT FOR ANGLE (RADIANS) MEASURED BETWEEN A VORTEX FILAMENT AND A FLOW-FIELD POINT RELATIVE TO THE ORIGIN OF THE VORTEX LOCAL COORDINATE SYSTEM.

DELALF (=1.0 IF OMITTED) ANGLE OF ATTACK INCREMENT BETWEEN THE TWO EXACT VORTEX-LATTICE SOLUTIONS THAT ARE GENERATED FOR DETERMINING THE LINEARIZED (LIFTING LINE) THEORY ARRAYS OF SOLUTIONS.

GROUP 4 - JOB/JOBS TERMINATION CARD

* REQUIRED INPUT FOR NSURF AND ISURF EXECUTION MODES *

CARD 1 FORMAT(9H $ENDJØBS) MUST HAVE $ENDJOBS IN COLUMNS 2-9 (COLUMN 1 FIELD MUST BE LEFT BLANK)

NOTE: INPUT INSTRUCTIONS FOR THE CALCOMP/4060-MICROFILM PLOT-OUTPUT OPTION, XQT TRWPLT, ARE FOUND IN REFERENCE 35. THESE INSTRUCTIONS HAVE BEEN OMITTED IN THE PRESENT REPORT.

3.5 ALPHABETICAL LIST OF INPUT QUANTITIES

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
AILDJ	REAL(2,5) REAL(2,10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	AILERON-SURFACES DEFLECTION. AILERON-SURFACES DEFLECTION.
ALFA	REAL(10) REAL(20)	DEG. DEG.	NSURF ONLY ISURF ONLY	ATTITUDE ATTITUDE	ANGLE OF ATTACK. ANGLE OF ATTACK.
AW	REAL	L**2	ISURF ONLY	OPT.CONS.	WETTED AREA.
C	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF.PLAN SURF.PLAN	CHORD LENGTH. CHORD LENGTH.
CLEANF	REAL	NONE	ISURF ONLY	OPT.CONS.	AERODYNAMIC CLEANNESS FACTOR.
CØLØCP	REAL	NONE	NONE	OPT.CONS.	COLOCATION OR CONTROL POINT.
CUTØF1	REAL	L/R	NONE	OPT.CONS.	CUTOFF LIMIT FOR RADIUS VECTOR.
CUTØF2	REAL	RADIAN	NONE	OPT.CONS.	CUTOFF LIMIT FOR SMALL ANGLES.
DELALF	REAL	DEG.	ISURF ONLY	OPT.CONS.	ANGLE OF ATTACK INCREMENT FOR LINEARIZED THEORY.
E	REAL(30) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	SURF.PLAN SURF.PLAN	CHORD PLANE GEOMETRIC TWIST. CHORD PLANE GEOMETRIC TWIST.
FLAPDJ	REAL(5) REAL(10)	DEG. DEG.	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	FLAP-SURFACE DEFLECTION. FLAP-SURFACE DEFLECTION.
FLAPC	REAL(30) REAL	L L	NSURF ONLY ISURF ONLY	FLAP/AIL. FLAP/AIL.	FLAP/AILERON CHORD LENGTH. FLAP/AILERON CHORD LENGTH.
GSCALE	REAL	NONE	NSURF ONLY	REF.DIM.	GEOMETRIC SCALING FACTOR.
HEIGHT	REAL(10)	L	NONE	ATTITUDE	ALTITUDE FROM GROUND PLANE.
IFLG	INTG(15)	NONE	ISURF ONLY	FLAG	JOB EXECUTION FLAG FOR ISURF.
KØUT	INTEGER	NONE	NONE	OUTPUT	BCD PRINT-OUTPUT UNIT ASSIG.
KT1	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG.
KT2	INTEGER	NONE	NONE	OUTPUT	CALCOMP/FILM BCD UNIT ASSIG.
KT3	INTEGER	NONE	NONE	OUTPUT	SCRATCH/WORK BCD UNIT ASSIG.
L	REAL	L	NONE	NONE	LINEAR DIMENSION, E.G., FEET, INCHES,METERS,ETC.
LDRAG	REAL	NONE	ISURF ONLY	OPT.CONS.	INDUCED DRAG FACTOR.
LFLAP	REAL	NONE	NONE	OPT.CONS.	LINEAR THEORY FACTOR FOR FLAP.
LINX	INTEGER	NONE	NONE	OUTPUT	MAX.NO.LINES PER PRINTED PAGE.
MACHN	REAL(10)	NONE	NONE	ATTITUDE	FLIGHT FREE-STREAM MACH NUMBER.
NCS	INTG(5)	NONE	NONE	AIRFOIL	NO.OF CHORD STATIONS.
NFLG	INTG(20)	NONE	NSURF ONLY	FLAG	JOB EXECUTION FLAG FOR NSURF.
NFUS	INTEGER	NONE	NSURF ONLY	SURF.TYPE	NO.SYMMETRIC FUS. SURFACES.
NJØB	INTEGER	NONE	NONE	ATTITUDE	NO.OF FLIGHT ATTITUDES.

3.5 ALPHABETICAL LIST OF INPUT QUANTITIES (CONTINUED)

VARIABLE	DIMENSION	UNITS	RESTRICTION	CLASS	DESCRIPTION AND/OR FUNCTION
NJØBL	INTEGER	NONE	ISURF ONLY	LINEAR OPT	NO,OF SEPARATE FLIGHT ATTITUDES FOR LIFTING-LINE SOLUTIONS,
NSØLV	INTG(12)	NONE	NSURF ONLY	ATTITUDE	MULTIPLE-SURFACE SOLUTION FLAG,
NSS	INTG(5)	NONE	NONE	SURF,PLAN	STORAGE ALLOCATION-ORDER INDEX,
NVTAIL	INTEGER	NONE	NSURF ONLY	SURF,TYPE	NO,VERT,ANTISYMM, SURFACES,
NWING	INTEGER	NONE	NSURF ONLY	SURF,TYPE	NO,SYMMETRIC WING SURFACES,
PMECF	REAL	NONE	ISURF ONLY	OPT,CONS,	PITCHING MOMENT FACTOR,
REFB	REAL	L	NSURF ONLY	REF,DIM,	REFERENCE SPAN LENGTH,
REFC	REAL	L	NSURF ONLY	REF,DIM,	REFERENCE CHORD LENGTH,
REFS	REAL	L**2	NSURF ONLY	REF,DIM,	REFERENCE AREA,
SF	REAL	L**2	ISURF ONLY	OPT,CONS	EQUIVALENT FLAT PLATE AREA,
TABC	REAL(30)	L	NSURF ONLY	FLAP/AIL,	TAB CHORD LENGTH,
TABDJ	REAL(5)	DEG,	NSURF ONLY	FLAP/AIL,	TAB-SURFACE DEFLECTION,
WCL	REAL(21)	NONE	ISURF ONLY	LINEAR OPT	WING LIFT COEFFICIENT FOR LIFTING LINE SOLUTIONS,
WFLAP1	REAL(5)	L	NONE	FLAP/AIL,	FLAP SPAN INNER-EDGE DIM,
WFLAP2	REAL(5)	L	NONE	FLAP/AIL,	AILERON SPAN INNER-EDGE DIM,
WFLAP3	REAL(5)	L	NONE	FLAP/AIL,	AILERON SPAN OUTER-EDGE DIM,
WSMØTH	REAL	L	NONE	OPT,CONS,	COSINE SMOOTHING SCALE,
XCG	REAL	L	NSURF ONLY	REF,DIM,	LONGITUDINAL LOCATION OF C,G,
X	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF,LOFT LINE X-COORDINATE, REF,LOFT LINE X-COORDINATE,
XØC	REAL(10,5) REAL(10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	CHORD STATION FOR AIRFOIL SECT, CHORD STATION FOR AIRFOIL SECT,
XØCR	REAL(30) REAL	L/C L/C	NSURF ONLY NSURF ONLY	SURF,PLAN SURF,PLAN	RELATIVE LOCATION OF REF,LOFT LINE, RELATIVE LOCATION OF REF,LOFT LINE,
Y	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF,LOFT LINE Y-COORDINATE, REF,LOFT LINE Y-COORDINATE,
YCG	REAL	L	NSURF ONLY	REF,DIM,	SPANWISE LOCATION OF C,G,
YSPAN	REAL(42)	L	ISURF ONLY	SURF,PLAN	SPAN STATIONS THAT BOUND VORTEX LATTICE ELEMENTS,
Z	REAL(30) REAL(10)	L L	NSURF ONLY ISURF ONLY	SURF,PLAN SURF,PLAN	REF,LOFT LINE Z-COORDINATE, REF,LOFT LINE Z-COORDINATE,
ZCG	REAL	L	NSURF ONLY	REF,DIM,	VERTICAL LOCATION OF C,G,
ZØC	REAL(10,30) REAL(10,10)	L/C L/C	NSURF ONLY ISURF ONLY	AIRFOIL AIRFOIL	MEAN CAMBER FOR AIRFOIL SECT, MEAN CAMBER FOR AIRFOIL SECT,

---

3.6 LIST OF ABBREVIATIONS FOR INPUT

AIL	AILERON
ASSIG.	ASSIGNMENT
CØNS.	CONSTANT
C.G.	CENTER OF GRAVITY
DEG.	DEGREES, ANGULAR MEASURE
DIM.	DIMENSION
.EQ.	EQUAL
E.G.	FOR EXAMPLE
.GE.	GREATER OR EQUAL
.GT.	GREATER THAN
IABS	ABSOLUTE VALUE OF AN INTEGER CONSTANT
INTG	INTEGER
I.E.	EQUIVALENT TO
.LE.	LESS OR EQUAL
.LT.	LESS THAN
ØPT.	OPTIONAL
REF	REFERENCE
SURF.	SURFACE
*	MULTIPLICATION
**	EXPONENTIATION

1.0 PROGRAM DATA TABLES

TABLE 4.01 - INITIAL VALUES

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
AILDJ	REAL(2,5) REAL(2,10)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
ALFA	REAL(10) REAL(20)	NSURF ONLY ISURF ONLY	10*0.0, 20*0.0,
C	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	2*100.0,28*0.0, 10*100.0,
CLEANF	REAL	ISURF ONLY	0.0035,
CØLØCP	REAL	NONE	0.75,
CUTØF1	REAL	NONE	0.0001,
CUTØF2	REAL	NONE	0.0029,
DELALF	REAL	ISURF ONLY	1.0,
E	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0.0, 10*0.0,
FLAPDJ	REAL(5) REAL(10)	NSURF ONLY ISURF ONLY	5*0.0, 10*0.0,
FLAPC	REAL(30) REAL	NSURF ONLY ISURF ONLY	30*0.25, 0.3,
GSCALE	REAL	NSURF ONLY	1.0,
HEIGHT	REAL(10)	NONE	10*1.0E+5,
IFLG	INTG(15)	ISURF ONLY	0,0,10,0,0,1,0,0,0,1,0,0,0,0,0,
KØUT	INTEGER	NONE	6,
KT1	INTEGER	NONE	1,
KT2	INTEGER	NONE	8,
KT3	INTEGER	NONE	3,
LDRAG	INTEGER	ISURF ONLY	0,
LFLAP	INTEGER	NONE	0,
LINX	INTEGER	NONE	56,
MACHN	REAL(10)	NONE	10*0.0,
MCS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
NFLG	INTG(20)	NSURF ONLY	10,0,0,0,0,4,0,0,0,0,0,0,0,0,0,0,0,1,0,4,
NFUS	INTEGER	NSURF ONLY	0,
NJØB	INTEGER	NONE	1,
NJØBL	INTEGER	ISURF ONLY	20,
NSØLV	INTG(12)	NSURF ONLY	1,1,10*0,
NSS	INTG(5) INTEGER	NSURF ONLY ISURF ONLY	2,4*0, 2,
NVTAIL	INTEGER	NSURF ONLY	0,
NWING	INTEGER	NSURF ONLY	1,
PMECF	REAL	ISURF ONLY	1,0,
REFB	REAL	NSURF ONLY	100,0,
REFC	REAL	NSURF ONLY	100,0,
REFS	REAL	NSURF ONLY	1000,0,
TABC	REAL(30)	NSURF ONLY	30*0,125,
TABDJ	REAL(5)	NSURF ONLY	5*0,0,
WCL	REAL(21)	ISURF ONLY	+1,0,-0,4,-0,3,-0,2,-0,1,+0,0,+0,1, +0,2,+0,3,+0,4,+0,5,+0,6,+0,7,+0,8, +0,9,+1,0,+1,1,+1,2,+1,3,+1,4,+1,5,
WFLAP1	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,0, 0,0,
WFLAP2	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*0,6, 0,6,
WFLAP3	REAL(5) REAL	NSURF ONLY ISURF ONLY	5*1,0, 1,0,
WSMØTH	REAL REAL	NSURF ONLY ISURF ONLY	0,1, 0,2,
XCG	REAL	NSURF ONLY	0,0,
X	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 10*0,0,
XØC	REAL(10,5) REAL(10)	NSURF ONLY ISURF ONLY	0,0,1,0,48*0,0, 0,0,1,0,8*0,0,

TABLE 4.01 - INITIAL VALUES (CONTINUED)

VARIABLE	DIMENSION	RESTRICTION	INITIAL VALUE/S
XØCR	REAL(30) REAL	NSURF ONLY ISURF ONLY	30*0,25, 0,25,
Y	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0.0, 0,0,100,0,8*1000,0,
YCG	REAL	NSURF ONLY	0,0,
YSPAN	REAL(42)	ISURF ONLY	42*0,0,
Z	REAL(30) REAL(10)	NSURF ONLY ISURF ONLY	30*0,0, 10*0,0,
ZCG	REAL	NSURF ONLY	0,0,
ZØC	REAL(10,30) REAL(10,10)	NSURF ONLY ISURF ONLY	300*0,0, 100*0,0,

5.0 OUTPUT

5.1 General Description of Output

The printed-output and tape-output for the main execution modes of the program are organized in the following manner.

1) Raw Data

The input data for all the case studies that are to be executed by the computer which includes punched card data up to and including the $ENDJØBS card is printed in the first page or pages in the exact form it was read into the computer, i.e., raw data including punched-card errors, etc.

2) Initial Values

For each individual case study to be executed the job-execution flags, geometry data, flight data, etc. are output via NAMELIST statement, i.e., the values of all the input variables are output via $INPUT.

2) Short-Print Output (NFLG(20) or IFLG(10) = 0)

The following tables are output under the short-print output option:

Table Title & Description	Table # in Section 5.2
Lifting-Surface Geometry (one for each surface)	Table 5.01
Camber for Airfoil Section (one for each surface)	Table 5.02
Section Airload Coefficients (one for each surface)	Table 5.03
Spatially-Integrated Airload Coefficients	Table 5.04
Linearized (Lifting-Line) Solutions (ISURF execution mode only)	Table 5.05
Job/Jobs Termination Output	Table 5.06

4) Long-Print Output (NFLG(20) or IFLG(10) $\geq$ 2)

The short-print tables and the following tables are output under the long-print option:

Table Title & Description	Table # in Section 5.2
Vortex-Lattice Geometry Detail (one for each surface)	Table 5.07
Lift Distribution Detail (one for each surface)	Table 5.08

5) Debug-Print Output (NFLG(20) or IFLG(10) ≥ 5)

In addition to the short-print and long-print tables, the following tables are output under the debug-print option

Table Title & Description	Table # in Section 5.2
Vortex-Lattice Induced Velocity Matrices Detail (one for each surface)	Table 5.09

6) Program Checkout-Print Output (NFLG(20) or IFLG(10 ≥ 16)

Under the program checkout-print option, detail data on the vortex-lattice velocity induced for each individual vortex filament is output via NAMELIST statement, accordingly

Table Title & Description	Table # in Section 5.2
Program Checkout & Debug Print	Table 5.10

7) Tape Output (NFLG(19) or IFLG (11) through IFLG(14) > 1)

A summary of the analytical solutions generated by the program is output on magnetic tape. This output is used by the auxiliary execution mode (TRWPLT) for generating 4060-microfilm or Calcomp output. A detailed description of the format and variables output on tape is presented in Section 5.3.

8) Execution Diagnostics and Job Abort Output

See Section 5.4.

9) Alphabetical List of Output Quantities

See Section 5.5.

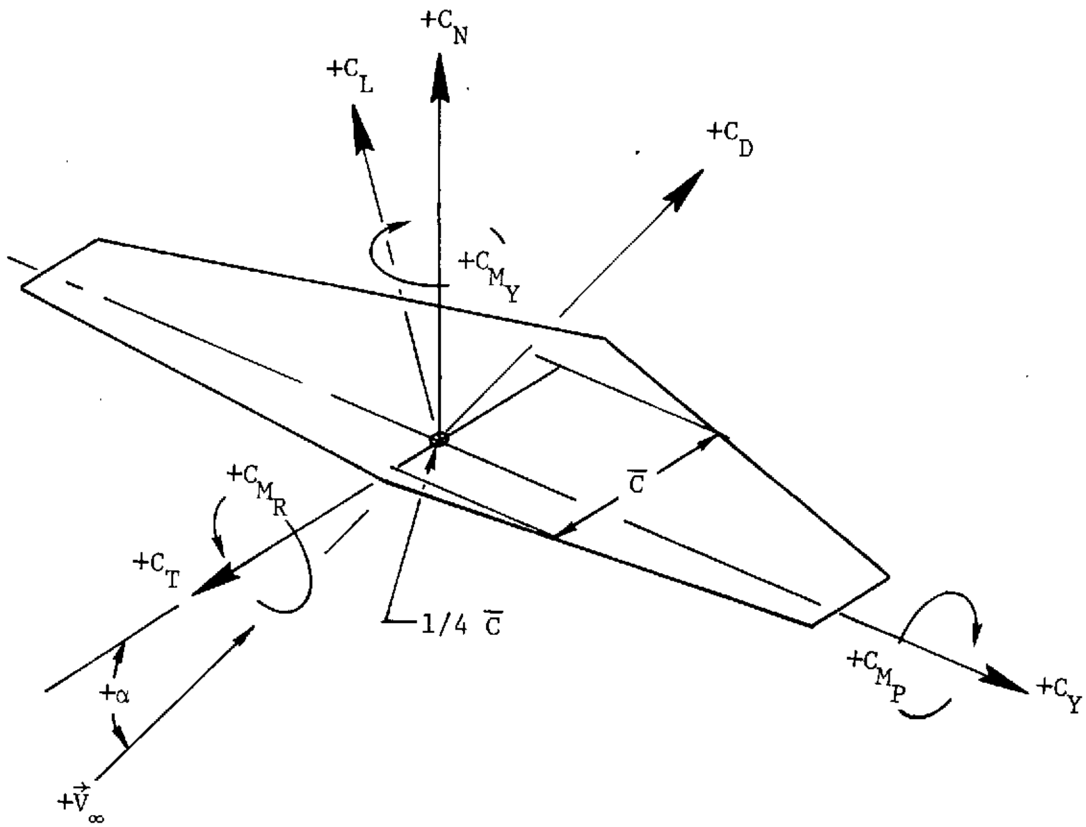
10) List of Abbreviations for Output

See Section 5.6.

11) Sign Conventions for Output

The sign conventions adopted for output purposes are described in Figure 5.01 (Page 5-3).

A) AIRLOAD AND MOMENT COEFFICIENTS



B) LIFTING-SURFACE GEOMETRY

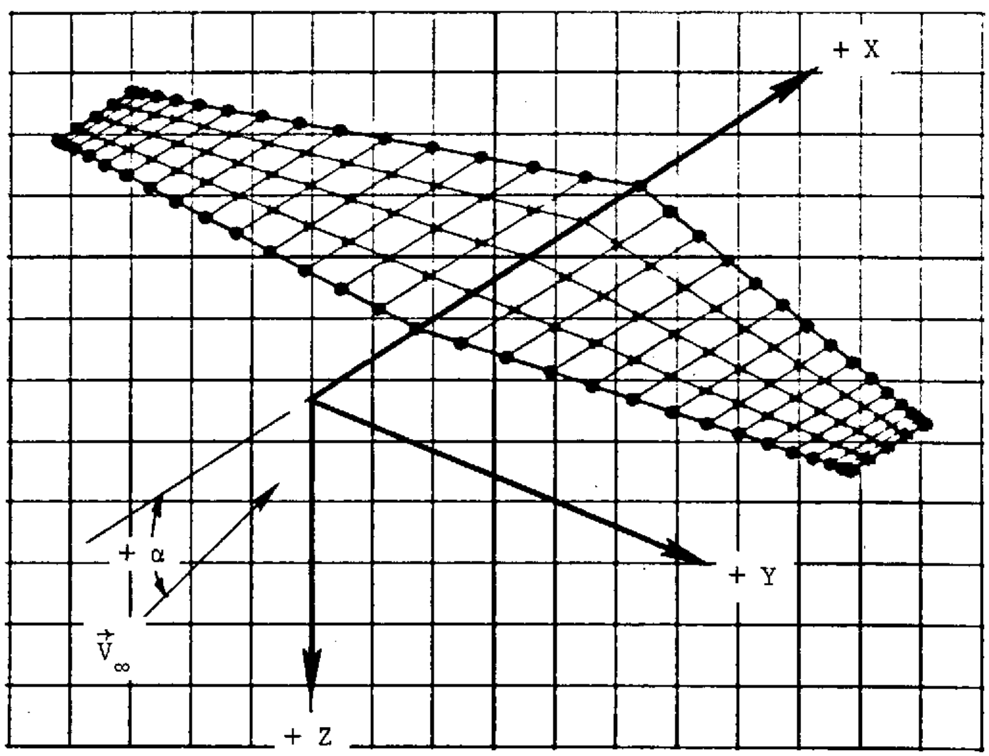


FIGURE 5.01 - LIFTING-SURFACE SOLUTIONS SIGN CONVENTIONS FOR OUTPUT

5.2 Printed-Output Format Summary

1) Short-Print Output

TABLE 5.01 - LIFTING-SURFACE GEOMETRY (One for Each Surface)

LIFTING SURFACE NC= N_1
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
b	C_R	C_T	ϵ_R	ϵ_T	S	AR	C_{mean}	$\bar{C}$	$\bar{Y}$	$\bar{X}$	$\bar{Z}$
FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO. CHORD DISCONT.
Y_1	Y_2	Y_3	δ_f	δ_{tab}	δ_{LA}	δ_{RA}	$\phi_{(\bar{C}/4)}$	$\Lambda_{(\bar{C}/4)}$	NSE	NCE	NCD
			FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)			
			X_{ref}	Y_{ref}	Z_{ref}	S_{ref}	$\bar{C}_{ref}$	b_{ref}			

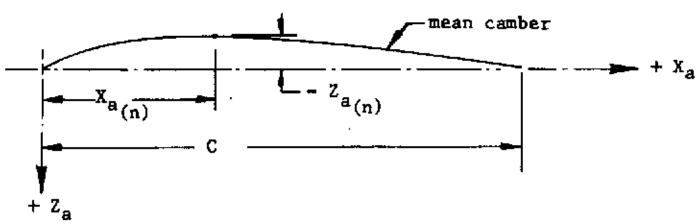
WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
W	Y	Z	X_{LE}	$X_{(\bar{C}/4)}$	X_{TE}	ϵ	$\phi_{(C/4)}$	$\Lambda_{(C/4)}$	c	c_f	c_{tab}

5.2 Printed-Output Format Summary (Continued)

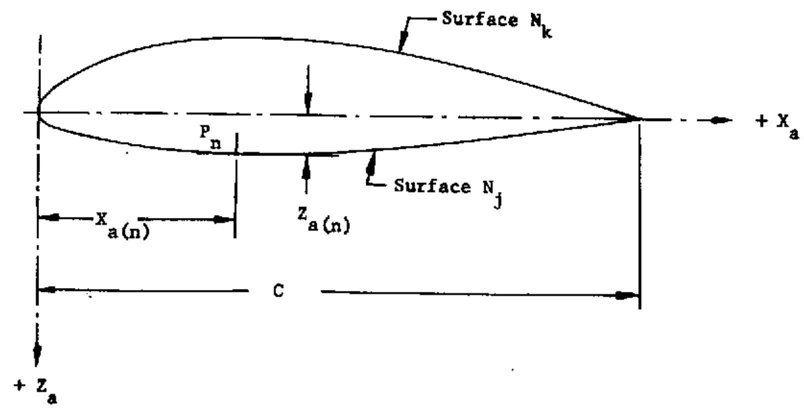
TABLE 5.02 - AIRFOIL-SECTION CAMBER (One for Each Surface)

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C

[A] Single-Surface Representation



[B] Two-Surface Representation



5.2 Printed-Output Format Summary (Continued)

TABLE 5.03 - SECTION AIRLOAD COEFFICIENTS (One for Each Surface)

[A] NSURF Execution Mode

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= $N_j/(N_i, N_k)$
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
j	Y/b	Y	Z	W	c_n	c_x	c_ℓ	c_d	$c_{m(C/4)}$	$c_\ell C/b$	section airloads unit vector		

[B] ISURF Execution Mode

SECTION LIFT COEFFCIENTS
****

J	2Y/B	Y	C	SCL	SCLC/B	DLIFT	SCM(C/4)	IXL	IYL	IZL
j	Y/(b/2)	Y	C	c_ℓ	c_ℓ C/b	$\Delta L/q_\infty$	$c_{m(C/4)}$	airload unit vector		

5.2 Printed-Output Format Summary (Continued)

TABLE 5.03 [B] - SECTION AIRLOAD COEFFICIENTS (Continued)

CHORDWISE PRESSURE DISTRIBUTION DETAIL
****

		* * * * * * * * * * * * * * * * * * CHORD STATION (X-XLE)/C * * * * * * * * * * * * * * * * * * *										
$(X - X_{LE})/C$ →		.00000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	1.00000
2Y/B	SCL	* * * * * * * * * * * * * * * * * * CHORD PRESSURE (CPL -CPU)*IZL * * * * * * * * * * * * * * * * * *										
Y/(b/2)	c_ℓ	$(c_{p_L} - c_{p_U})$ →										

SPANWISE SECTION LIFT DISTRIBUTION DETAIL
****

		WITH LE SUCTION			NO LE SUCTION			FLAP/AILERON		
Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCH
Y	Y/(b/2)	c_ℓ	c_{d_i}	$c_{m(C/4)}$	c_{ℓ_v}	$c_{d_{i,v}}$	$c_{m_v(C/4)}$	c_{n_f}	c_{x_f}	c_{h_f}

TABLE 5.04 - SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS

[A] NSURF Execution Mode

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= N_i - N_k
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
N_j	C_N	C_X	C_Y	C_L	C_{D_i}	$C_{M(\bar{c}/4)}$	$C_{M_{roll}}$	$C_{M_{yaw}}$	$\bar{X}_{(\bar{c}/4)}$	$Z_{(\bar{c}/4)}$	S	$\bar{c}$	b

*** AIRLOAD SUMS ***

AC CG AC CG													

* DETERMINANT= Δ * SCALE= s *

[B] ISURF Execution Mode

WING AIRLOAD COEFFICIENTS
****

	WCL	WCDI	WCMP	WCMR	WCMY	IXL	IYL	IZL	DELTA	SCALE
	C_L	C_{D_i}	$C_{M(\bar{c}/4)}$	$C_{M_{roll}}$	$C_{M_{yaw}}$		airload unit vector		Δ	s
WITH LE SUCTION NO LE SUCTION										

Note: Starred entries in the table (*) refer to calculated values of vortex-lift increments.

5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (ISURF Execution Mode Only)

[A] Basic Lift Distribution

LINEARIZED SOLUTION WING COEFFICIENTS
****

	WITH LE SUCTION			NO LE SUCTION		
ALFA	WCL	WCD	WCM(C/4)	WCL	WCD	WCM(C/4)
	C_L	C_D	$C_{M(\bar{C}/4)}$	C_{L_v}	C_{D_v}	$C_{M_v(\bar{C}/4)}$

[B] Linearized Solutions

LINEARIZED SOLUTION WITH LE SUCTION
****

ALFA	ALFARO	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
α	αR_o	C_L	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$

		WITH LE SUCTION			NO LE SUCTION			FLAP/AILERON		
Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCH
Y	Y/(b/2)	c_ℓ	c_{d_i}	$c_{m(C/4)}$	c_{ℓ_v}	$c_{d_{i,v}}$	$c_{m_v(C/4)}$	c_{n_f}	c_{x_f}	c_{h_f}

WITH LE SUCTION WCL= C_L / WCDI= C_{D_i} / WCM(C/4)= $C_{M(\bar{C}/4)}$ / L/D= C_L/C_{D_i}
NO LE SUCTION / / /

5.2 Printed-Output Format Summary (Continued)

TABLE 5.05 - LINEARIZED (LIFTING-LINE) SOLUTIONS (Continued)

[C] Spatially-Integrated Linearized Solutions

```
                 LINEARIZED SOLUTION WITH LE SUCTION
                 ***********************************

ALFA     ALFARO     WCL      WCL      CMP      CMR      CMY
                            SLOPE    SLOPE    SLOPE
```

ALFA	ALFARO	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
α	αR_o	C_L	$\bar{m}$	$\bar{m}_{pitch}$	$\bar{m}_{roll}$	$\bar{m}_{yaw}$

Y	2Y/B	SCLAL	SCLB	SCL	SCM(1/4)
Y	Y/(b/2)	$c_{\ell al}$	$c_{\ell b}$	c_ℓ	$c_{m(C/4)}$
↓	↓	↓	↓	↓	↓

TABLE 5.06 - JOB/JOBS TERMINATION OUTPUT

[A] NSURF Execution Mode

**** JOB TIME= t_1 / ELAPSED TIME= t_2 / NO,PLOT FILES= n_p / NSURF EXEC, VERSION 6-18-72 ****

```
*****************************************************************************************
*****************************************************************************************
```

[B] ISURF Execution Mode

**** JOB TIME= t_1 / ELAPSED TIME= t_2 / NO,PLOT FILES= n_p / ISURF EXEC, VERSION 6-18-72 ****

```
*****************************************************************************************
*****************************************************************************************
```

5.2 Printed-Output Format Summary (Continued)

2) Long-Print Output

TABLE 5.07 - VORTEX-LATTICE GEOMETRY DETAIL (One for Each Surface)

J	K	Y	Z	WL	EW	DWL	DC	DS
j	k	Y	Z	W	$W - W_o$	ΔW	ΔC	ΔS

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
j	k	Coordinates of B(X,Y,Z)			Unit Vector $\vec{1BD}$			Control Point P(X,Y,Z)			Normal Unit Vector $\vec{1N}$		

5.2 Printed-Output Format Summary (Continued)

TABLE 5.08 - LIFT DISTRIBUTION DETAIL (One for Each Surface)

LIFT DISTRIBUTION DETAIL-SURFACE NO.= N_j/(N_i, N_k)
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
j	k	Coordinates of C(X,Y,Z)			ΔS	$(c_{p_L} - c_{p_U})$	Unit Vector $\vec{IV}$			Induced Velocity Vector $\vec{V}_i$			$\Gamma_{j,k}$

3) Debug-Print Output

TABLE 5.09 - VORTEX-LATTICE INDUCED VELOCITY MATRICES DETAIL (One for Each Surface)

VORTEX LATTICE MATRIX DETAIL-SURFACE NO.= N_j/(N_i, N_k)
****

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
j	k	m	n	$\vec{V}_\infty \cdot \vec{IN}_n$	$\vec{\psi}_{m,n} \cdot \vec{IN}_n$	Control Point $P(X,Y,Z)_n$			Coordinates of $B(X,Y,Z)_m$			Coordinates of $D(X,Y,Z)_m$		

5.2 Printed-Output Format Summary (Continued)

4) Program Checkout and Debug Print Output

TABLE 5.10 - PROGRAM CHECKOUT AND DEBUG PRINT

[A] Induced Velocity Calculation Detail-Print

Origin: Subroutine VØRTEX (A13 or B11)

$DBUGV1		Branch ∞-A-B
P	= P(X,Y,Z)	
B	= B(X,Y,Z)	
D	= D(X,Y,Z)	
TANA	= Tan(α)	
GAMA	= Γ	
PSIF	= ψ	
VCOS	= $1\vec{V}_i$	
$END		

$DBUGV2		Branch D-E-∞
PSIF	= ψ	
VCOS	= $1\vec{V}_i$	
$END		

$DBUGV3		Branch B-C-D
PSIF	= ψ	
VCOS	= $1\vec{V}_i$	
$END		

[B] Ground Effect Mirror Image Calculation Detail-Print

Origin: Subroutine REFLEC (A10 or B12)

$REFLEX	
PX	= X of P(X,Y,Z)
PY	= Y of P(X,Y,Z)
X1	= X coordinate for intermediate point
Y1	= Y coordinate for intermediate point
PHI	= ϕ, rotation angle (radians)
ALFAR	= α, angle of attack (radians)
RX	= X coordinate of mirror-image point
RY	= Y coordinate of mirror-image point
ZL	= Z coordinate to ground plane
COSR	= Cos(ϕ)
$END	

5.3 Tape-Output Format Summary

In exercising the Calcomp/4060-microfilm plot-option of the program through the execution of XQT TRWPLT, the auxiliary execution mode, a data tape (or an internal unit) has to be provided in addition to the plotting instructions. The data tape is generated in the main execution modes of program, XQT NSURF or XQT ISURF, when the tape output option is specified in the input, i.e., NFLG(19) $\neq$ 0 or IFLG(12), IFLG(13), and IFLG(14) $\neq$ 0. The data in the data-tape is organized into a number of separate files, each file containing a single solution or a separate class of information. The data in each file is organized as illustrated below:

Execution Mode	File No.	Type of Information	Reference
NSURF	#1	Geometry for 1st. Surface	Example #1
	#2	Geometry for 2nd. Surface	(Section 6.2)
	#3	Geometry for 3rd. Surface	
	#4, #5	Geometry for 4th. Surface	
	#6, #7	Geometry for 5th. Surface	
ISURF	#1	Geometry for 1st. Surface	Example #2
	#2	Chordwise pressure distribution	(Section 6.3)
	#3	Spanwise airload distribution	
	#4	Linearized airload solution	

The data record format adopted for each file is given by

IREC, N, $DATA_1$, $DATA_2$, ..., $DATA_N$,

IREC, N, $DATA_1$, $DATA_2$, ..., $DATA_N$,

" " " " "

" " " " "

END ØF FILE

where

IREC is the record type or number

N is the number of variables

$DATA_i$ is the i^{th} variable in the record

The definition of the variables that are output in the data-tape is presented in Table 5.11.

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TABLE 5.11 - TAPE-OUTPUT FORMAT SUMMARY

File	Execution Mode	Origin Routine No.	Record No. IREC	No. Words N	Data	Function
i	NSURF	A03	1	6	X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},	Isometric Projection of the N^{th} Lifting-Surface Geometry
			2	3	X_{F1}, Y_{F1}, Z_{F1},	
			3	3	X_{F2}, Y_{F2}, Z_{F2},	
j	ISURF	B03	1	7	Y, X_{LE}, $X_{C/4}$, X_{TE}, X_{HF}, C_W, C_F,	Ortographic Projection of the I^{th} Lifting-Surface Geometry
			2	2	Y_{F1}, X_{F1},	
			3	2	Y_{F2}, X_{F2},	
			4	3	Y, Z_{LE}, Z_{TE},	
			5	6	X_{LE}, Y_{LE}, Z_{LE}, X_{TE}, Y_{TE}, Z_{TE},	Isometric Projection of the I^{th} Lifting-Surface Geometry
			6	3	X_{F1}, Y_{F1}, Z_{F1},	
			7	3	X_{F2}, Y_{F2}, Z_{F2},	
k	ISURF	B05	1	2	X/C, $(c_{p_U} - c_{p_L})$	Chordwise Pressure Distribution
			2	10	Y/b, c_ℓ, c_d, $c_{m(C/4)}$, c_{n_f}, c_{x_f}, c_{h_f}, c_{ℓ_v}, c_{d_v}, $c_{m_v(C/4)}$,	Span Distribution of Section Airload Coefficients for Vortex-Lattice Solution
l	ISURF	B06	1	10	Y/b, c_ℓ, c_d, $c_{m(C/4)}$, c_{n_f}, c_{x_f}, c_{h_f}, c_{ℓ_v}, c_{d_v}, $c_{m_v(C/4)}$	Span Distribution of Section Airload Coefficients for Linearized Solutions
			2	7	α, C_L, C_D, $C_{M(\bar{C}/4)}$, C_{L_v}, C_{D_v}, $C_{M_v(\bar{C}/4)}$,	Spatially-Integrated Airload Coefficients

5.4 Execution Diagnostics and Job Abort Output

Aside from the system (the computer) diagnostic error messages that may be output in the normal execution of the program, diagnostic or job termination messages are output when unallowable errors are incurred in the execution. Generally, these errors result because of bad input or because some of the calculated dependent variables fall outside the range of the program. A complete list of the error messages that may be output by the program and the corrective action that should be taken for each individual case is presented below:

1) JØB ABØRTED BECAUSE, NØ. ØF LIFTING SURFACES = N EXCEEDS FIVE

Origin:	Subroutine LØFT (A03)
Cause:	The number of lifting surfaces specified in the input exceeds the maximum number of lifting surfaces allowed in execution.
Correction:	The absolute value sum of NWING, NFUS, and NVTAIL must be less than or equal to five. Revise accordingly.

2) JØB ABØRTED BECAUSE, NØ. ØF SPAN ELEMENTS = NSE EXCEEDS 60

Origin:	Subroutine LØFT (A03)
Cause:	The number of spanwise elements of the vortex-lattice geometric configuration exceeds the maximum number of allowable elements.
Correction:	Decrease the number of spanwise elements in the vortex-lattice by revising the entries in NFLG(1), NFLG(2), .., NFLG(5).

3) JØB ABØRTED BECAUSE, NØ. ØF CHØRD ELEMENTS = NCE EXCEEDS TEN

Origin:	Subroutine LØFT (A03)
Cause:	The vortex-lattice number of chordwise elements assigned to the N^{th} surface exceeds the maximum allowable number.
Correction:	The value assigned to NFLG(6), NFLG(7),1,or, NFLG(10) cannot exceed 10. Revise these entries accordingly.

5.4 Execution Diagnostics and Job Abort Output (Continued)

4) JØB ABØRTED BECAUSE, NØ. ØF VØRTEX-LATTICE ELEMENTS = NVME EXCEEDS 100

Origin:	Subroutine LIFTX (A04)
Cause:	Too many elemental panels are considered simultaneously in obtaining a solution, i.e., the number of elements in the induced-velocity matrix exceeds the maximum allowable number.
Correction:	A smaller number of lifting-surfaces or a smaller number of elemental panels per surface has to be considered in obtaining a solution. To achieve these objectives revise the entries made for NSØLV, and NFLG(1) through NFLG(10).

5) JØB ABØRTED BECAUSE, MACH NØ. = MACHN EXCEEDS 0.90

Origin:	Subroutine MAIN (A01)
Cause:	The free stream Mach Number assigned to a given solution exceeds the maximum allowable limit of the program.
Correction:	Revise the entries made for the MACHN array.

6) JØB ABØRTED BECAUSE, NØ. ØF SPAN STATIØNS = NSS EXCEEDS 30

Origin:	Subroutine LØFT (A03)
Cause:	Too much data input for the X, Y, Z, E, C, and XØCR arrays.
Correction:	Revise entries for NSS, X, Y, Z, E, C, and XØCR.

7) JØB ABØRTED BECAUSE, NØ. ØF CHØRD STATIØNS = NSC EXCEEDS 10

Origin:	Subroutine LØFT (A03)
Cause:	Too much data input for XØC and ZØC arrays.
Correction:	Revise entries for NCS, XØC, and ZØC.

8) JØB ABØRTED BECAUSE, NØ. ØF SPAN ELEMENTS = NSPE NØT PERMITTED

Origin:	Subroutine LØFT (A03)
Cause:	The number of span elements assigned to any lifting surface has to be a positive integer.
Correction:	Revise (increase) entries for NFLG(1), through NFLG(5).

9) JØB ABØRTED BECAUSE, NØ. ØF WING CHØRD ELEMENTS = NWCE NØT PERMITTED

Origin:	Subroutine LØFT (A03)
Cause:	Too few chordwise elements assigned to the N^{th} lifting surface.
Correction:	Revise (increase) entries for NFLG(6) through NFLG(10).

10) JØB ABØRTED BECAUSE, INPUT ERRØR IN NSS FLAG, NSS(N) = I1.LT.NSS(M)=I2

Origin:	Subroutine LØFT (A03)
Cause:	Input error incurred in the NSS array specification.
Correction:	Revise entries for NSS array.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES

*** PROGRAM OUTPUT OPTIONS ***

(1) - SHORT-PRINT OUTPUT,   NFLG(20).OR.IFLG(10).EQ.0.

(2) - LONG-PRINT OUTPUT,   NFLG(20).OR.IFLG(10).GE.2.

(3) - DEBUG-PRINT OUTPUT,   NFLG(20).OR.IFLG(10).GE.5.

(4) - PROGRAM-CHECKOUT,   NFLG(20).OR.IFLG(10).GE.8.

(5) - PLOT TAPE OUTPUT.   NFLG(19).OR.(IFLG(I),I=11,14).GE.1.

*** INPUT-DATA OUTPUT - NAMELIST INPUT ***

NAMELIST INPUT.   SEE INPUT VARIABLES LIST (SECTION 3.4) FOR DEFINITION OF INPUT VARIABLES IN NAMELIST INPUT.

*** STANDARD-PRINT OUTPUT - SHORT-PRINT, LONG-PRINT, OR DEBUG-PRINT ***

VARIABLE	COMMENT	UNITS †	DEFINITION
AC	INTG.COEFF.		AERODYNAMIC CENTER FOR ELEMENTAL SURFACE NO. 1.
ALFA		DEG.	ANGLE OF ATTACK MEASURED RELATIVE TO THE FREE STREAM VECTOR AND THE X-COORDINATE AXIS.
ALFARØ	ISURF	DEG.	WING ANGLE OF ATTACK FOR CL=0.0.
ALTITUDE		L	ALTITUDE ABOCE THE GROUND PLANE, I.E., THE SHORTEST STRAIGHT-LINE DISTANCE MEASURED FROM THE COORDINATE SYSTEM ORIGIN (X=Y=Z=0) TO THE GROUND PLANE.
AREA	GEOMETRY	L**2	PROJECTED AREA OF LIFTING SURFACE.
AREA	ND.GE.2	L**2	AREA OF AN ELEMENTAL SURFACE.
AREA S(CG)	GEOMETRY	L**2	REFERENCE AREA USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
ASPECT RATIØ	GEOMETRY		ASPECT RATIO OF LIFTING SURFACE, I.E., EQUAL TO (SPAN**2)/AREA
B(X)	ND.GE.5	L	X-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
B(Y)	ND.GE.5	L	Y-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
B(Z)	ND.GE.5	L	Z-COORDINATE OF POINT B(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
C(FLAP)	GEOMETRY	L	CHORD LENGTH OF FLAP AND/OR AILERONS.

†Blank entries denote dimensionless quantities.

VARIABLE	COMMENT	UNITS	DEFINITION
C(TAB)	GEOMETRY	L	CHORD LENGTH OF TAB OR AUXILIARY FLAP SURFACE.
C(WING)	GEOMETRY	L	CHORD LENGTH OF LIFTING SURFACE CHORD-PLANE.
CG	INTG.COEFF.		CENTER OF GRAVITY LOCATION DEFINED BY REFERENCE DIMENSIONS.
CHØRD C(CG)	GEOMETRY	L	REFERENCE CHORD LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
CMP SLØPE	ISURF		WING PITCHING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMP)/D(ALFA).
CMR SLØPE	ISURF		WING ROLLING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMR)/D(ALFA).
CMY SLØPE	ISURF		WING YAWING MOMENT COEFFICIENT SLOPE, I.E., = D(WCMY)/D(ALFA).
CPN	ND.GE.2		NORMAL FORCE PRESSURE COEFFICIENT FOR AN ELEMENTAL SURFACE.
D(X)	ND.GE.5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
D(Y)	ND.GE.5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
D(Z)	ND.GE.5	L	X-COORDINATE OF POINT D(X,Y,Z) THAT DEFINES THE GEOMETRY OF THE VORTEX FILAMENT B-D.
DC	ND.GE.1	L	CHORD INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
*DETERMINANT	INTG.COEFF.		VALUE OF DETERMINANT IN VORTEX-LATTICE MATRIX INVERSION.
DIHED(MGC/4)	GEOMETRY	DEG.	DIHEDRAL ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS.
DS	ND.GE.1	L**2	TRUE AREA INCREMENT OF A VORTEX-LATTICE ELEMENTAL SURFACE.
DWL	ND.GE.1	L	TRUE SPAN DIMENSION OF A VORTEX-LATTICE ELEMENTAL SURFACE.
E	INTG.COEFF.		DESIGNATION OF ELEMENTAL SURFACE (NTH SURFACE).
EB	INTG.COEFF.	L	SPAN OF ELEMENTAL SURFACE.
ECD	INTG.COEFF.		INDUCED DRAG COEFFICIENT FOR ELEMENTAL SURFACE.
ECL	INTG.COEFF.		LIFT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMP	INTG.COEFF.		PITCHING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMR	INTG.COEFF.		ROLLING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE.
ECMY	INTG.COEFF.		YAWING MOMENT COEFFICIENT FOR ELEMENTAL SURFACE

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ECN	INTG.COEFF.		NORMAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECX	INTG.COEFF.		HORIZONTAL FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ECY	INTG.COEFF.		SIDE FORCE COEFFICIENT FOR ELEMENTAL SURFACE.
ELAPSED TIME	COMMENT		TIME ELAPSED SINCE START OF EXECUTION.
EMGC	INTG.COEFF.	L	MEAN GEOMETRIC CHORD OF ELEMENTAL SURFACE.
ES	INTG.COEFF.	L**2	AREA OF ELEMENTAL SURFACE.
EW	ND.GE.1	L	TRUE SPAN COORDINATE MEASURED AT POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT.
EXA	INTG.COEFF.	L	LONGITUDINAL STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
EZA	INTG.COEFF.	L	WATERLINE STATION FOR 1/4-CHORD POINT LOCATION OF ELEMENTAL SURFACE MEAN GEOMETRIC CHORD.
FCH	ISURF		HINGE MOMENT SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCN	ISURF		NORMAL FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FCX	ISURF		CHORDWISE FORCE SECTION COEFFICIENT FOR FLAP OR AILERON CONTROL SURFACES.
FLAP DEFLEC	GEOMETRY	DEG.	FLAP DEFLECTION, I.E., + = DOWN.
FLAP SPAN1	GEOMETRY	L OR L/B	SPAN LOCATION OF THE INNER EDGE OF THE FLAP.
FLAP SPAN2	GEOMETRY	L OR L/B	SPAN LOCATION OF THE OUTER EDGE OF THE FLAP OR INNER EDGE OF THE AILERON.
FLAP SPAN3	GEOMETRY	L OR L/B	SPAN LOCATION OF THE OUTER EDGE OF THE AILERON.
FUS STA X(CG)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY.
GAMA	ND.GE.2		STRENGTH OR CONCENTRATED VORTICITY FOR THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE DEFINED BY THE POINTS B(X,Y,Z) AND D(X,Y,Z).
G(X)	ND.GE.2		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
G(Y)	ND.GE.2		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
G(Z)	ND.GE.2		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE LINE OF ACTION OF THE LIFT FORCE ACTING ON AN ELEMENTAL SURFACE.
J			SPAN ARGUMENT OR INDEX.
JØB TIME	COMMENT		TIME ELAPSED FOR EXECUTION OF LAST JOB.

VARIABLE	COMMENT	UNITS	DEFINITION
K			CHORD ARGUMENT OR INDEX.
L/D	ISURF		LIFT TO DRAG RATIO.
L.AIL DEFLEC	GEOMETRY	DEG.	LEFT AILERON DEFLECTION, I.E., + = DOWN, AND, - = UP.
MACHN			MACH NUMBER OF THE FREE STREAM VELOCITY.
MEAN CHØRD	GEOMETRY	L	MEAN CHORD OF LIFTING SURFACE, I.E., EQUAL TO AREA/SPAN
MGC (MAC)	GEOMETRY	L	MEAN GEOMETRIC CHORD THAT IS DEFINED EQUAL TO THE MEAN AERODYNAMIC CHORD.
ND	OUTPUT		VALUE ASSIGNED TO NFLG(20) OR IFLG(10).
NG	ND.GE.5		SECOND ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX.
NØ.CHØRD DISCØN.	GEOMETRY		NUMBER OF CHORD DISCONTINUITIES FOR THE LIFTING SURFACE VORTEX-LATTICE REPRESENTATION.
NØ.CHØRD ELEMENTS	GEOMETRY		NUMBER OF CHORD ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION.
NØ.PLØT FILES	COMMENT		NUMBER OF FILES OUTPUT ON UNIT KT2 THAT ARE USED IN THE PROGRAM PLOTTING OPTION.
NØ.SPAN ELEMENTS	GEOMETRY		NUMBER OF SPAN ELEMENTS FOR THE LIFTING-SURFACE VORTEX-LATTICE REPRESENTATION.
NP	ND.GE.5		FIRST ARGUMENT OR INDEX OF VORTEX-LATTICE INFLUENCE COEFFICIENT MATRIX.
P(X)	ND.GE.2	L	X-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
P(Y)	ND.GE.2	L	Y-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
P(Z)	ND.GE.2	L	Z-COORDINATE OF A FIELD POINT ABOUT WHICH THE INDUCED VELOCITY IS CALCULATED.
RØØT CHØRD	GEOMETRY	L	CHORD LENGTH OF THE ROOT STATION.
RØØT TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE ROOT, STATION (WASHIN), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN.
R.AIL DEFLEC	GEOMETRY	DEG.	RIGHT AILERON DEFLECTION, I.E, + = DOWN, AND, - = UP.
*SCALE	INTG.COEFF.		AVERAGE VALUE OF ELEMENTS IN THE VORTEX-LATTICE MATRIX
SCD	SECT.COEFF.		SECTION DRAG COEFFICIENT.
SCDI	ISURF		SECTION COEFFICIENT FOR INDUCED DRAG.
SCL	SECT.COEFF.		SECTION LIFT COEFFICIENT.
SCLA1	ISURF		ADDITIONAL LIFT DISTRIBUTION SECTION LIFT COEFFICIENT.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
SCLB	ISURF		BASIC LIFT DISTRIBUTION (WCL=0.0) SECTION LIFT COEFFICIENT.
SCLC/B	SECT.COEFF.		SECTION SPAN LOADING COEFFICIENT, I.E., SCL*(C/B).
SCN	SECT.COEFF.		SECTION NORMAL AIRLOAD COEFFICIENT, I.E., ACTING IN THE -Z DIRECTION.
SCX	SECT.COEFF.		SECTION CHORDWISE AIRLOAD COEFFICIENT, I.E., ACTING IN THE +X DIRECTION.
SMP C/4	SECT.COEFF.		SECTION PITCHING-MOMENT COEFFICIENT ABOUT THE LOCAL 1/4-CHORD LOCATION.
SPAN	GEOMETRY	L	SPAN OF LIFTING SURFACE.
SPAN B(CG)	GEOMETRY	L	REFERENCE SPAN LENGTH USED FOR NORMALIZING THE C.G. AERODYNAMIC COEFFICIENTS.
SWEEP(MGC/4)	GEOMETRY	DEG.	SWEEPBACK ANGLE BASED ON THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD AND ROOT CHORD SPAN STATIONS.
TAB DEFLEC	GEOMETRY	DEG.	TAB DEFLECTION, I.E., + = DOWN,AND,- = UP.
TIP CHØRD	GEOMETRY	L	CHORD LENGTH OF THE TIP STATION.
TIP TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF CHORD PLANE AT THE TIP, STATION (WASHOUT), WHERE, + = LEADING EDGE UP, AND - = LEADING EDGE DOWN.
TWIST	GEOMETRY	DEG.	GEOMETRIC TWIST OF THE CHORD PLANE, WHERE, + = LEADING EDGE UP,AND, - = LEADING EDGE DOWN.
VFS(MAT)	NO.GE.5	V/UFS	FREE STREAM VECTOR VELOCITY COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z).
VIN(MAT)	NO.GE.5	V/UFS	INDUCED VELOCITY VECTOR COMPONENT NORMAL TO THE ELEMENTAL SURFACE AT THE COLOCATION POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT DEFINED BY B(X,Y,Z) AND D(X,Y,Z) POINTS.
VI(X)	NO.GE.2	V/UFS	X-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
VI(Y)	NO.GE.2	V/UFS	Y-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
VI(Z)	NO.GE.2	V/UFS	Z-COMPONENT OF THE VELOCITY VECTOR INDUCED BY THE SUM OF ALL ELEMENTAL SURFACE VORTEX FILAMENTS.
W	SECT.COEFF.	L	CUMULATIVE WETTED-SPAN DIMENSION IN CORE.
WCDI	ISURF		WING INDUCED DRAG COEFFICIENT.
WCL	ISURF		WING LIFT COEFFICIENT.
WCL SLØPE	ISURF		WING LIFT SLOPE, I.E., WCL/(ALFA-ALFARØ)

VARIABLE	COMMENT	UNITS	DEFINITION
WCMP	ISURF		WING PITCHING MOMENT COEFFICIENT ABOUT 1/4 MAC. (MAC= MEAN AERODYNAMIC CHORD)
WCMR	ISURF		WING ROLLING MOMENT COEFFICIENT,
WCMY	ISURF		WING YAWING MOMENT COEFFICIENT,
WING STA Y(CG)	GEOMETRY	L	SPAN STATION (Y-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WL	ND.GE.1	L	SPAN COORDINATE IN-CORE FOR POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT.
WL STA Z(CG)	GEOMETRY		VERTICAL WATER-LINE STATION (Z-COORDINATE) FOR THE LOCATION OF THE CENTER OF GRAVITY,
WS	GEOMETRY	L	WETTED-LENGTH SPAN STATION,
X		L	X-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
XA(N)/C	CAMBER	L/C	CHORD STATION NORMALIZED BY CHORD LENGTH FOR THE NTH.LOCATION, N=1,2,3,.....,10.
XBAR	GEOMETRY	L	LONGITUDINAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD,
X(C/4)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE 1/4-CHORD LOCATION OF THE CHORD PLANE.
X(LE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE LEADING EDGE OF THE CHORD PLANE,
XN	ND.GE.1	L	X-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
X(TE)	GEOMETRY	L	LONGITUDINAL STATION (X-COORDINATE) OF THE TRAILING EDGE OF THE CHORD PLANE,
XV	ND.GE.1	L	X-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT.
Y		L	Y-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
Y*	SECT.COEFF.		DIMENSIONLESS SPAN COORDINATE, I.E., Y/SPAN,
YBAR	GEOMETRY	L	SPAN COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD.
YN	ND.GE.1	L	Y-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
YV	ND.GE.1	L	Y-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
Z		L	Z-COORDINATE DEFINED FOR A RIGHT-HAND LOFT COORDINATE SYSTEM,
ZA(N)/C	CAMBER	L/C	VERTICAL LOCATION OF MEAN-CAMBER PLANE RELATIVE TO THE CHORD PLANE AND NORMALIZED BY THE CHORD,
ZBAR	GEOMETRY	L	VERTICAL COORDINATE FOR THE 1/4-CHORD LOCATION OF THE MEAN GEOMETRIC CHORD.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
ZN	ND.GE.1	L	Z-COORDINATE OF THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
ZV	ND.GE.1	L	Z-COORDINATE OF POINT B OF AN ELEMENTAL SURFACE VORTEX FILAMENT
1XL	SECT.COEFF.		UNIT VECTOR IN THE +X DIRECTION FOR SECTION AIRLOAD.
1XN	ND.GE.1		X-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1XV	ND.GE.1		X-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1YL	SECT.COEFF.		UNIT VECTOR IN THE +Y DIRECTION FOR SECTION AIRLOAD.
1YN	ND.GE.1		Y-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1YV	ND.GE.1		Y-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.
1ZL	SECT.COEFF.		UNIT VECTOR IN THE +Z DIRECTION FOR SECTION AIRLOAD.
1ZN	ND.GE.1		Z-COMPONENT OF THE NORMAL-UNIT-VECTOR AT THE COLOCATION POINT OF AN ELEMENTAL SURFACE.
1ZV	ND.GE.1		Z-COMPONENT OF THE UNIT VECTOR THAT DEFINES THE SPANWISE ORIENTATION OF THE VORTEX FILAMENT OF AN ELEMENTAL SURFACE.

* PROGRAM-CHECKOUT OUTPUT - NAMELIST DBUGV1, DBUGV2, DBUGV3, OR REFLEX *

VARIABLE	COMMENT	UNITS	DEFINITION
ALFAR	ND.GT.15	RAD.	ANGLE OF ATTACK.
B	ND.GE.5	L	X-Y-Z COORDINATES OF POINT B(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
CØSR	ND.GT.15		COSINE(ALFAR).
D	ND.GE.5	L	X-Y-Z COORDINATES OF POINT D(X,Y,Z) THAT DEFINES THE LOCATION OF THE ELEMENTAL VORTEX FILAMENT B-D.
GAMA	ND.GE.5		STRENGTH OR CONCENTRATED VORTICITY OF THE VORTEX FILAMENT B-D.
P	ND.GE.5	L	X-Y-Z COORDINATES OF THE FIELD POINT P(X,Y,Z).
PHI	ND.GT.15	RAD.	ROTATION ANGLE.

5.5 ALPHABETICAL LIST OF OUTPUT QUANTITIES (CONTINUED)

VARIABLE	COMMENT	UNITS	DEFINITION
PSIF	ND.GE.5		INFLUENCE FUNCTION PSI.
PX	ND.GT.15	L	X-COORDINATE.
PY	ND.GT.15	L	Y-COORDINATE.
RX	ND.GT.15	L	X-COORDINATE FOR IMAGE POINT.
RY	ND.GT.15	L	Y-COORDINATE FOR IMAGE POINT.
TANA	ND.GE.5		TANGENT OF ALPHA.
VCØS	ND.GE.5		X-Y-Z COMPONENTS OF THE INDUCED VELOCITY VECTOR AT POINT P(X,Y,Z) DUE TO THE VORTEX FILAMENT B-D.
X1	ND.GT.15	L	X-COORDINATE FOR INTERMEDIATE POINT.
Y1	ND.GT.15	L	Y-COORDINATE FOR INTERMEDIATE POINT.
ZL	ND.GT.15	L	ALTITUDE.

5.6 LIST OF ABBREVIATIONS FOR OUTPUT

ALFA	ANGLE OF ATTACK
AIL	AILERON
ASSIG.	ASSIGNMENT
CAMBER	AIRFOIL SECTION MEAN CAMBER SPECIFICATIONS
CL	LIFT COEFFICIENT
CØNS.	CONSTANT
C.G.	CENTER OF GRAVITY
DEG.	ANGLE MEASURED IN DEGREES
DIM.	DIMENSION
.EQ.	EQUAL
E.G.	FOR EXAMPLE
GEØMETRY	LIFTING SURFACE GEOMETRY SPECIFICATIONS
.GE.	GREATER OR EQUAL
.GT.	GREATER THAN
INTG.CØEFF.	SPATIALLY-INTEGRATED COEFFICIENTS
I.E.	EQUIVALENT TO

5.6 LIST OF ABBREVIATIONS FOR OUTPUT (CONTINUED)

L	LINEAR DIMENSION
.LE.	LESS OR EQUAL
.LT.	LESS THAN
L/B	LINEAR DIMENSION NORMALIZED BY THE SPAN
L/C	LINEAR DIMENSION NORMALIZED BY THE CHORD
L**2	AREA UNITS, I.E., LINEAR UNITS SQUARED
ND.GE.1	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 1
ND.GE.2	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 2
ND.GE.5	NFLAG(20) OR IFLAG(10) GREATER OR EQUAL TO 5
ND.GT.15	NFLAG(20) OR IFLAG(10) GREATER THAN 15
ØPT.	OPTIONAL
RAD.	ANGLE MEASURED IN RADIANS
REF	REFERENCE
SECT.CØEFF.	AIRLOAD SECTION COEFFICIENTS
SURF.	SURFACE
V/UFS	VELOCITY NORMALIZED BY THE FREE STREAM VELOCITY
*	MULTIPLICATION
**	EXPONENTIATION

6.0 EXAMPLE PROBLEMS

6.1 INPUT-DATA LISTINGS

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION

```
************************************************************************
```

```
∇Z RUN T54589,TRW,1001.3303A,1001,C,5,1                     GOMEZ   TRW
∇ PLT
∇N MSG     FILE REQ.   TAPE  1  FH432  3  FSTRN  1
∇ ASG X=A10202
∇ ASG F
∇ XQT CUR
  TRW X
  ERS
  PEF X
  IN X
  TRI X
∇ XQT NSURF
 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                        A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=2, NFUS=1, NVTAIL=-2,
 MWING=1,
 NSS(1)=3, NCS(1)=2, NFLG(1)=28, NFLG(6)=4, NFLG(11)=1,
 X(1)=3*30., Y(1)=0.,40.,140., Z(1)=2*0.,-17.633, E(1)=2*4.,-1., XOCR(1)=3*1.,
 C(1)= 2*40.,10., XOC(1,1)=0.,1., FLAPC(1)=3*0.30, TABC(1)=3*0.08,
 FLAPDJ(1)= 40., AILDJ(1,1)=-20.,15., WFLAP1(1)=0.,WFLAP2(1)=40.,WFLAP3(1)=140.,
 MHTAIL=1,
 NSS(2)=5, NCS(2)=2, NFLG(2)=8, NFLG(7)=3, NFLG(12)= 1,
 X(4)=2*150., Y(4)=0.,40., Z(4)= 2*-20., E(4)=2*-2., XOCR(4)=2*1., C(4)=30.,20.,
 XOC(1,2)=0.,1., FLAPC(4)=2*10., TABC(4)=2*3.,
 FLAPDJ(2)=-30.,                        WFLAP1(2)=0.,WFLAP2(2)=40.,WFLAP3(2)=40.,
 MFUSEL=1,
 NSS(3)=7, NCS(3)=2, NFLG(3)=2, NFLG(8)=4,
 X(6)=2*-50., Y(6)=2*0., Z(6)=0.,-20., E(6)=2*0., XOCR(6)=2*0., C(6)=80.,200.,
 XOC(1,3)=0.,1.,
 MVTAIL=1,
 NSS(4)=9, NCS(4)=2, NFLG(4)=3, NFLG(9)=4, NFLG(14)=1,
 X(8)=2*150.,  Y(8)=2*40., Z(8)=-10.,-40., E(8)=2*0., XOCR(8)=2*1.,
 C(8)=25.,10., XOC(1,4)=0.,1., FLAPC(8)=2*0.5, TABC(8)=2*0.10,
 FLAPDJ(4)= 30.,                        WFLAP1(4)=0.,WFLAP2(4)=30.,WFLAP3(4)=30.,
 NACELE=1,
 NSS(5)=12, NCS(5)=2, NFLG(5)=2, NFLG(10)=6,
 X(10)=3*-30., Y(10)=3*40., Z(10)=10.,0.,-10., E(10)=3*0., XOCR(10)=3*0.,
 C(10)=30., 2*60., XOC(1,5)=0.,1.,
 XCG=0.0, REFC=32.681, REFB=280.0, REFS=8200.0,
 KT2=8, NFLG(19)=1, NJOB=1, ALFA=10., MACHN=0.2, NSOLV=12*0,
 $END
 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
 $INPUT
 NWING=2, NFUS=0, NVTAIL=0, NFLG(19)=0, NSOLV=1,1, 1,2,  FLAPDJ= 30.,-10.,
 NFLG(1)=14,4,
 $END
 $ENDJOBS
∇ XQT TRWPLT
  KUNIT = 8
  ICCOMP= 0
  NTRAN = 0
  IPRINT= 0
  NTYPE = 0
  NOFSCL= 1
  ISCALY = 1,1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPOSN1 = 600, 950
  NPOSN2 = 600, 925
  NPOSN3 = 600, 900
  NPOSN4 = 600, 50
 ANNOT1 = 10 = EXAMPLE PROB. 1 - MULTIPLE-SURFACE
 ANNOT2 = 10 =   CAPABILITY DEMONSTRATION RUN
 ANNOT3 = 10 =           A.GOMEZ/ 5 JULY 72
 ANNOT4 = 10 =
  CHARSZ = 1.0,1.0,1.0,1.0
  TITLE = 10 = ISOMETRIC PROJECTION OF LIFTING SURFACES
  XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
  YLABEL = 10 = VERTICAL AXIS  SEMISPANS
  XHI= 1.5
  XLO=-1.0
  YHI= 1.5
  YLO=-1.0
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  ANOTSV = 0
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
```

39 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT NSURF

120 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT TRWPLT (PLOT-OPTION)

ORIGINAL PAGE IS OF POOR QUALITY

GENERAL NOTES:
1. ∇ = 7/8 PUNCH
2. COMMENTS ARE PRINTED IN *"ITALIC TYPE"*
3. DASHED-LINES INDICATE THE START OF A NEW OUTPUT PAGE (- - - - - - - - - - - - - -)
4. BROKEN-SOLID-LINES INDICATES OUTPUT HAS BEEN EDITED (——— - ——— - ———)

```
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
 ENDRUN
∇EOF
```

```
EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
*************************************************************************

∇Z RUN T54589,TRW,1002,3303A,1002,C,5,1                    GOMEZ   TRW
∇N MSG     FILE REQ.    TAPE  1  FH432  3  FSTRN  1
∇ ASG X=A10202
∇ ASG F
∇ PLT
∇ XQT CUR
  TRW X
  EPS
  PFF X
  IN X
∇ XQT ISURF
 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO, HA010B (NSURF)
                                A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NSS=2, NCS=2, IFLG(2)=0,16,0, IFLG(5)=1,4,0, IFLG(8)=1, IFLG(10)=5,
 X=2*0.0, Y=0.0,30.0, Z=2*0.0, E=2*0.0, C=15.0,5.0, XDCR=0.25, XDC=0.0,1.0,
 WFLAP1=0., WFLAP2=0.625, WFLAP3=1.0, FLAPC=0.25, WSMOTH=0.25,
 PHECF=1, LDRAG=1, CLEANF=0.0035, NJOB=1, MACHN=0.2, ALFA=8, DELALF=-12,
 FLAPDJ=30.0, AILDJ=10.0,-15.0,
 KT2=8, IFLG(11)=4*1,
 NJOBL=9, WCL=1, 0.,0.25,0.5,0.75,1.0,1.25,1.5,1.75,2.0,
 $END
```

14 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT ISURF

```
∇ XQT TRWPLT
  KUNIT = 8
  ICCOMP= 0
  NTRAN = 0
  IPRINT= 0
  NTYPE = 0
  NOFSCL= 1
  ISCALY = 1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPOSN1 = 600, 950
  NPOSN2 = 600, 925
  NPOSN3 = 600, 900
  NPOSN4 = 600, 50
  CHARSZ = 1.0, 1.0, 1.0, 1.0
  ANNOT1 = 10 = EXAMPLE PROB. 2 - SINGLE-SURFACE
  ANNOT2 = 10 =   CAPABILITY DEMONSTRATION RUN
  ANNOT3 = 10 =            A.GOMEZ/ 5 JULY 72
  ANNOT4 = 10 =
```

305 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT TRWPLT (13 FIGURES)

```
  TITLE  = 10 = LIFTING SURFACE PLANFORM GEOMETRY
  XLABEL = 10 = HORIZONTAL AXIS, SEMISPANS
  YLABEL = 10 = VERTICAL AXIS  SEMISPANS
  XLO =-1.1
  XHI = 1.1
  YLO = -.5
  YHI = 1.7
  PLOT = 1,1, 2,1, 4,1, ENDLST
 ENDPLT
  ANOTSV = 0
  NOADV= 1
  PLOT = 1,2, 2,2, ENDLST
 ENDPLT
  NOADV= 1
  PLOT = 1,3, 2,3, ENDLST
 ENDPLT
  NOADV= 1
  PLOT = 1,4, 2,4, 3,4, ENDLST
 ENDPLT
```

FIGURE # 1, PLANFORM VIEW OF WING

```
  TITLE = ID = ISOMETRIC PROJECTION OF WING PLANFORM
  YLO = -1.1
  YHI = 1.1
  PLOT = 1,5,  2,5,  ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 3,5,  4,5,  ENDLST
 ENDPLT
  NOADV = 1
  PLOT  =  1,6,  2,6,  ENDLST
 ENDPLT
  NOADV = 1
  PLOT  =  1,7,  2,7,  ENDLST
 ENDPLT
  PLOT = 5,5, 2,5, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 6,5, 4,5, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 3,6, 2,6, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 3,7, 2,7, ENDLST
 ENDPLT
 ENDFIL
```

FIGURE # 2, ISOMETRIC PROJECTION OF WING

```
  ANNOT1 = 10 = EXAMPLE PROB. 2 - SINGLE-SURFACE
  ANNOT2 = 10 =   CAPABILITY DEMONSTRATION RUN
  ANNOT3 = 10 =            A.GOMEZ/ 5 JULY 72
  ANNOT4 = 10 =
  CHARSZ = 1.0, 1.0, 1.0, 1.0
  TITLE  = 10 = CHORDWISE PRESSURE DISTRIBUTION (CPL-CPU)
  XLABEL = 10 = HORIZONTAL DISTANCE, CHORDS
  YLABEL = 10 = DIFFERENTIAL PRESSURE COEFFICIENT
  XLO = 0.0
  XHI = 3.2
  YLO =-3.0
  YHI = 9.0
  CADD = 0.0, 0.0
  PLOT = 1,1, 2,1, ENDLST
 ENDPLT
  NOADV = 1
  CADD = 0.2, 0.5
  PLOT = 1,2, 2,2, ENDLST
 ENDPLT
```

FIGURE # 3, CHORDWISE PRESSURE DISTRIBUTION

```
 NOADV = 1
 CADD = 0.4, 1.0
 PLOT = 1,4, 2,4, ENDLST
ENDPLT
 NOADV = 1
 CADD = 0.6, 1.5
 PLOT = 1,6, 2,6, ENDLST
ENDPLT
 NOADV = 1
 CADD = 0.8, 2.0
 PLOT = 1,8, 2,8, ENDLST
ENDPLT
 NOADV = 1
 CADD = 1.0, 2.5
 PLOT = 1,9, 2,9, ENDLST
ENDPLT
 NOADV = 1
 CADD = 1.2, 3.0
 PLOT = 1,11,2,11,ENDLST
ENDPLT
 NOADV = 1
 CADD = 1.4, 3.5
 PLOT = 1,13,2,13,ENDLST
ENDPLT
 NOADV = 1
 CADD = 1.6, 4.0
 PLOT = 1,15,2,15,ENDLST
ENDPLT
 NOADV = 1
 CADD = 1.8, 4.5
 PLOT = 1,16,2,16,ENDLST
ENDPLT
ENDFIL
 TITLE  = 10 = SPAN AIRLOAD DISTRIBUTION
 XLABEL = 10 = HORIZONTAL DISTANCE, SEMISPANS
 YLABEL = 10 = SECTION LIFT COEFFICIENT  CL
 CADD = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
 XLO =-1.2
 XHI = 1.2
 YHI = 3.0
 YLO = -1.0
 PLOT = 1,1, 2,1, ENDLST
ENDPLT
 YLABEL = 10 = SECTION INDUCED DRAG COEFFICIENT  CDI
 PLOT = 1,1, 3,1, ENDLST
ENDPLT
 YLABEL = 10 = SECTION PITCHING MOMENT COEFFICIENT  CMAC
 YLO = -1.5
 YHI = 1.0
 PLOT = 1,1, 4,1, ENDLST
ENDPLT
ENDFIL
 TITLE  = 10 = LINEAR SOLUTION - SPAN AIRLOAD DISTRIBUTION
 XLABEL = 10 = HORIZONTAL DISTANCE, SEMISPANS
 YLABEL = 10 = SECTION LIFT COEFFICIENT  CL
 XLO = -1.2
 XHI = 1.2
 YLO = -1.5
 YHI = 3.0
 PLOT  = 1,1, 2,1, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,2, 2,2, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,3, 2,3, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,4, 2,4, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,5, 2,5, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,6, 2,6, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,7, 2,7, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,8, 2,8, ENDLST
 ENDPLT
 YLABEL = 10 = SECTION INDUCED DRAG COEFFICIENT  CDI
 PLOT  = 1,1, 3,1, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,2, 3,2, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,3, 3,3, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,4, 3,4, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,5, 3,5, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,6, 3,6, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,7, 3,7, ENDLST
 ENDPLT
 NOADV = 1
 PLOT  = 1,8, 3,8, ENDLST
 ENDPLT
 YLABEL = 10 = SECTION PITCHING MOMENT COEFFICIENT  CMAC
 YLO = -1.5
 YHI = 1.0
 PLOT = 1,1,  4,1,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,2,  4,2,  ENDLST
ENDPLT
```

FIGURE # 4, SECTION LIFT COEFFICIENT

FIGURE # 5, SECTION INDUCED DRAG COEFFICIENT

FIGURE # 6, SECTION PITCHING MOMENT COEFFICIENT

FIGURE # 7, SECTION LIFT COEFFICIENT ARRAY (LINEAR SOLUTION)

FIGURE # 8, SECTION INDUCED DRAG COEFFICIENT ARRAY (LINEAR SOLUTION)

FIGURE # 9, SECTION PITCHING MOMENT COEFFICIENT ARRAY (LINEAR SOLUTION)

6.1 INPUT-DATA LISTINGS (CONTINUED)

```
 NOADV = 1
 PLOT = 1,3,  4,3,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,4,  4,4,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,5,  4,5,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,6,  4,6,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,7,  4,7,  ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,8,  4,8,  ENDLST
ENDPLT
 YLABEL= ID = FLAP/AIL NORMAL FORCE COEFF  CNF
 YLO = -2.0
 YHI = 4.0
 PLOT = 1,1, 5,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,2, 5,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,3, 5,3, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,4, 5,4, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,5, 5,5, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,6, 5,6, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,7, 5,7, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,8, 5,8, ENDLST
ENDPLT
 YLABEL= ID = FLAP/AIL HORIZ FORCE COEFF  CXF
 PLOT = 1,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,2, 6,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,3, 6,3, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,4, 6,4, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,5, 6,5, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,6, 6,6, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,7, 6,7, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,8, 6,8, ENDLST
ENDPLT
 YLABEL= ID = FLAP/AIL HINGE MOMENT COEFF  CHF
 YLO = -1.5
 YHI = 1.0
 PLOT = 1,1, 7,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,2, 7,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,3, 7,3, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,4, 7,4, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,5, 7,5, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,6, 7,6, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,7, 7,7, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 1,8, 7,8, ENDLST
ENDPLT
 YLABEL = ID = WING AIRLOAD COEFFICIENTS
 XLABEL = ID = WING ANGLE OF ATTACK, ALFA
 XLO = -15.0
 XHI = 25.0
 YLO = -1.0
 YHI = 3.0
 PLOT = 1,9, 2,9, 3,9, 4,9, ENDLST
ENDPLT
ENDFIL
ENDRUN
∇EOF
```

FIGURE # 10, FLAP NORMAL FORCE SECTION COEFFICIENT ARRAY (LINEAR SOLUTION)

FIGURE # 11, FLAP CHORD FORCE SECTION COEFFICIENT ARRAY (LINEAR SOLUTION)

FIGURE # 12, FLAP HINGE MOMENT SECTION COEFFICIENT ARRAY (LINEAR SOLUTION)

FIGURE # 13, WING AIRLOAD COEFFICIENTS (LINEAR SOLUTION)

```
EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
*******************************************************************

∇Z RUN T54889,TRW,1003,3303A,1003,C,5,1                    GOMEZ   TRW
∇N MSG      FILE REQ.    TAPE  1  FH432  3  FSTRN  1
∇ ASG X=A10202
∇ ASG F
∇ PLT
∇ XQT CUR
  TRW X
  ERS
  PEF X
  IN X
∇ XQT NSURF
 EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO, HA010B (NSURF)
                                    A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=3,NVTAIL=-1, GSCALE=0.083333, COLOCP=0.80,
 MWING=1,
 NSS(1)=7,NCS(1)=2,NFLG(1)=22,NFLG(6)=6,XOC(1,1)=0.0,1.0,
 X(1)=-50.5,-50.5,-50.5,-50.5,3*0.0, XOCR(1)=7*1.0,
 Y(1)=0.,57.27,114.54,171.81,229.08,400.89,629.97,
 Z(1)=2*0.0,0.441,0.882,3*0.0,
 E(1)=2*0.0,-0.5,-1.0,-1.5,-3.0,-3.0,
 C(1)=1413.08,1281.518,1110.456,984.394,908.832,530.647,26.4,
 MCANRD=1
 NSS(2)=9,NCS(2)=3,NFLG(2)=6,NFLG(7)=2,XOC(1,2)=0.0,0.5,1.0,
 X(8)=-1723.0,-1723.0, XOCR(8)=0.55,0.31532,
 Y(8)=0.0,171.81,
 Z(8)=-73.0,-73.0,
 E(8)=2*3.0,
 C(8)=249.5,96.71,
 ZOC(1,8)=0.0,0.0,0.08816,
 ZOC(1,9)=0.0,0.0,0.08816,
 MFUS=1,
 NSS(3)=11,NCS(3)=2,NFLG(3)=2,NFLG(8)=3,XOC(1,3)=0.0,1.0,
 X(10)=-1463.08,-1312.018, Y(10)=0.,57.27, Z(10)=2*0.0,E(10)=2*0.0,
 C(10)=740.0,640.0,XOCR(10)=1.0,1.0,XOC(1,3)=0.,1.0,
 MFINS=1,
 NSS(4)=13, NCS(4)=2, NFLG(4)=3, NFLG(9)=2,  XOC(1,4)=0.0,1.0, XOCR(12)=2*1.0,
 X(12)=-50.5,36.0, Y(12)=2*171.81, Z(12)=0.882,-171.81, E(12)=-1.0,-1.0,
 C(12)=328.1313,83.07,
 XCG=-725.9, ZCG=5.5,YCG=0.0, REFS=906883.0, REFC=942.38, REFB=1260.0,
 NJOB=1, ALFA=10, MACHN= 0.20, NSOLV=1,1,1,2,1,4,
 KT2= 8,        NFLG(19)= 1, 0,
 $END
 $ENDJOBS
∇ XQT TRWPLT
  KUNIT = 8
  ICCOMP= 0
  NTRAN = 0
  IPRINT= 0
  NTYPE = 0
  NOFSCL= 1
  ISCALY = 1,1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPOSN1 = 600, 950
  NPOSN2 = 600, 925
  NPOSN3 = 600, 900
  NPOSN4 = 600, 50
  ANNOT1 = ID = EXAMPLE PROB, 3 - XB-70 AIRPLANE
  ANNOT2 = ID =  SUBSONIC AERODYNAMIC ANALYSIS
  ANNOT3 = ID =              A.GOMEZ/ 5 JULY 72
  ANNOT4 = ID =
  CHARSZ = 1.0,1.0,1.0,1.0
  TITLE = ID = ISOMETRIC PROJECTION OF LIFTING SURFACES
  XLABEL = ID = HORIZONTAL AXIS, SEMISPANS
  YLABEL = ID = VERTICAL AXIS  SEMISPANS
  XHI=  2.0
  XLO= -2.0
  YHI=  2.0
  YLO= -2.0
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  ANOTSV = 0
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,3, 3,3, ENDLST
 ENDPLT
 ENDFIL
  NOADV = 1
  PLOT = 2,1, 3,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 5,1, 6,1, ENDLST
 ENDPLT
  NOADV = 1
  PLOT = 2,2, 3,2, ENDLST
 ENDPLT
```

36 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT NSURF

108 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT TRWPLT (PLOT OPTION)

ORIGINAL PAGE IS OF POOR QUALITY

6.1 INPUT-DATA LISTINGS (CONTINUED)

```
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
 NOADV = 1
 PLOT = 2,1, 3,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 5,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,2, 3,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
 NOADV = 1
 PLOT = 2,1, 3,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 5,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,2, 3,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
 NOADV = 1
 PLOT = 2,1, 3,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 5,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,2, 3,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
∇EOF
```

```
 EXAMPLE PROBLEM NO. 4 - THICK WING PHOBLEM AERODYNAMIC ANALYSIS
 ****************************************************************

∇Z RUN T54589,TRW,1004,3303A,1004,C,2,1                      GOMEZ   TRW
∇N MSG      FILE REQ.    TAPE  1  FH432  3  FSTRN  1
∇ ASG X=410202
∇ ASG F
∇ PLT
∇ XQT CUR
   TRW X
   ERS
   PEF X
   IN X
∇ XQT NSURF
 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC ANALYSIS
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO, HA010B (NSURF)
                            A.V.GOMEZ/ 5 JULY 1972

 $INPUT
 NWING=3, NVTAIL=0, NFUS=0, COLOCP=0.75,
 NFLG(1)=3*10, NFLG(6)=3*5, NFLG(19)=1,2,
 NCS=2*10,2, NSS=2,4,6,
 THICKW= 1,
 XOC(1,1)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
 XOC(1,2)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
 ZOC(1,1)=.0,.04443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
 ZOC(1,2)=.0,.04443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
 ZOC(1,3)=.0,-.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
 ZOC(1,4)=.0,-.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
 X = 0.0,    0.0,
 Y = 0.10,   0.10,
 Z = 0.0,    0.0,
 C = 10.10,  10.10,
 E = 0.0,    0.0,
 Z = 0.0, 0.0,
 FLATP= 1,
 XOC(1,3)= .00, 1.0,
 ZOC(1,5)=.0, .0,
 ZOC(1,6)=.0, .0,
 X(5)= 0.0,
 Y(5)= 0.10,
 Z(5)= 0.0,
 C(5)= 10.10,
 E(5)= 0.0,
 XCG=0.0, REFC=10.0, REFB=20.0, REFS=200.0,
 NJOB=1, ALFA=10, MACHN=0.0, NSOLV=1,2,3,3
 $END
 $ENDJOBS
```

35 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT NSURF

```
∇ XQT TRWPLT
  KUNIT = 8
  ICCOMP= 0
  NTRAN = 0
  IPRINT= 0
  NTYPE = 0
  NOFSCL= 1
  ISCALY = 1,1,1,1,1,1,1,1,1,1
  NXL = 24
  NXR = 24
  NYL = 24
  NYH = 24
  NPOSN1 = 600, 950
```

62 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT TRWPLT (PLOT OPTION)

```
 NPOSN2 = 600, 925
 NPOSN3 = 600, 900
 NPOSN4 = 600, 50
 CHARSZ = 1.0, 1.0, 1.0, 1.0
 ANNOT2 = ID * SUBSONIC AERODYNAMIC ANALYSIS
 ANNOT2 = ID * SUBSONIC AERODYNAMIC ANALYSIS
 ANNOT3 = ID *          A.GOMEZ/ 5 JULY 72
 ANNOT4 = ID *
 CHARSZ = 1.0,1.0,1.0,1.0
 TITLE = ID = ISOMETRIC PROJECTION OF LIFTING SURFACES
 XLABEL = ID * HORIZONTAL AXIS, SEMISPANS
 YLABEL = ID * VERTICAL AXIS  SEMISPANS
 XLO = -1.0
 XHI =  2.0
 YLO = -1.0
 YHI =  2.0
 XLO=-2.0
 XHI= 3.0
 YLO=-2.0
 YHI= 3.0
 PLOT = 2,1, 3,1, ENDLST
ENDPLT
 ANOTSV = 0
 NOADV = 1
 PLOT = 5,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,2, 3,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
 NOADV = 1
 PLOT = 2,1, 3,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 5,1, 6,1, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,2, 3,2, ENDLST
ENDPLT
 NOADV = 1
 PLOT = 2,3, 3,3, ENDLST
ENDPLT
ENDFIL
ENDRUN
7EOF
```

EXAMPLE PROBLEM NO. 5 - DEBUG-PRINT OUTPUT OPTIONS DEMONSTRATION

```
***************************************************************************

∇7 RUN T54589,TRW,1005,3303A,1005,C,1,1                    GOMEZ   TRW
∇N MSG     FILE REQ.   TAPE  1  FH432  3  FSTRN  0
∇ ASG X=A10202
∇ XQT CUR
  TRW X
  ERS
  IN X
  TRI X
∇ XQT NSURF
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=1,
 NSS(1)=2, NCS(1)=2, NFLG(1)=3, NFLG(6)=2, NFLG(11)=1,
 X(1)=2*0., Y(1)=0.,10., Z(1)=2*0., E(1)=2*0., C(1)=2*10., XOCR(1)=2*0.25,
 XOC(1)=0.,1., FLAPDJ(1)= 10., NJOB=1, ALFA= 5, MACHN= 0., NSOLV=1,1,
 NFLG(20)= 0,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1
 $INPUT
 NFLG(20)= 1,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2
 $INPUT
 NFLG(20)= 2,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5
 $INPUT
 NFLG(20)= 5,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8
 $INPUT
 NFLG(20)= 8,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16
 $INPUT
 NFLG(20)= 16,  NFLG(17)=1,
 $END
 $ENDJOBS

∇ XQT NSURFT
∇ XQT ISURFT
∇EOF
```

33 PUNCHED-CARDS INPUT DECK REQUIRED FOR XQT NSURF

6.2 EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY

```
                         SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B

                                 TRW SYSTEMS INC., HOUSTON OPERATIONS

                                        HOUSTON, TEXAS (77058)

           **** JOBS INPUT LIST ****

 7 XQT NSURF
  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
  TASK 702, PROJECT 3303A, MJO 14703J, AERODYNAMIC ANALYSIS AND DESIGN
  SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                      A.V.GOMEZ/ 5 JULY 1972
  $INPUT
  NWING=2, NFUS=1, NVTAIL=-2,
  MWING=1,
  NSS(1)=3, NCS(1)=2, NFLG(1)=28, NFLG(6)=4, NFLG(11)=1,
  X(1)=3*30., Y(1)=0.,40.,140., Z(1)=2*0.,-17.633, E(1)=2*4.,-1., XOCR(1)=3*1.,
  C(1)= 2*40.,10., XOC(1,1)=0.,1., FLAPC(1)=3*0.30, TABC(1)=3*0.08,
  FLAPDJ(1)= 40., AILDJ(1,1)=-20.,15., WFLAP1(1)=0.,WFLAP2(1)=40.,WFLAP3(1)=140.,
  MHTAIL=1,
  NSS(2)=5, NCS(2)=2, NFLG(2)=8, NFLG(7)=3, NFLG(12)= 1,
  X(4)=2*150., Y(4)=0.,40., Z(4)= 2*-20., E(4)=2*-2., XOCR(4)=2*1., C(4)=30.,20.,
  XOC(1,2)=0.,1., FLAPC(4)=2*10., TABC(4)=2*5.,
  FLAPDJ(2)=-30.,                         WFLAP1(2)=0.,WFLAP2(2)=40.,WFLAP3(2)=40.,
  MFUSEL=1,
  NSS(3)=7, NCS(3)=2, NFLG(3)=2, NFLG(8)=4,
  X(6)=2*-50., Y(6)=2*0., Z(6)=0.,-20., E(6)=2*0., XOCR(6)=2*0., C(6)=80.,200.,
  XOC(1,3)=0.,1.,
  MVTAIL=1,
  NSS(4)=9, NCS(4)=2, NFLG(4)=3, NFLG(9)=4, NFLG(14)=1,
  X(8)=2*150.,  Y(8)=2*40., Z(8)=-10.,-40., E(8)=2*0., XOCR(8)=2*1.,
  C(8)=25.,10., XOC(1,4)=0.,1., FLAPC(8)=2*0.5, TABC(8)=2*0.10,
  FLAPDJ(4)= 30.,                         WFLAP1(4)=0.,WFLAP2(4)=30.,WFLAP3(4)=30.,
  NACELE=1,
  NSS(5)=12, NCS(5)=2, NFLG(5)=2, NFLG(10)=6,
  X(10)=3*-30., Y(10)=3*40., Z(10)=10.,0.,-10., E(10)=3*0., XOCR(10)=3*0.,
  C(10)=30., 2*60., XOC(1,5)=0.,1.,
  XCG=0.0, REFC=32.681, REFB=280.0, REFS=6200.0,
  KT2=8, NFLG(19)=1, NJOB=1, ALFA=10., MACHN=0.2, NSOLV=12*0,
  $END
  EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
  $INPUT
  NWING=2, NFUS=0, NVTAIL=0, NFLG(19)=0, NSOLV=1,1, 1,2,  FLAPDJ= 30.,-10.,
  NFLG(1)=14,4,
  $END
  $ENDJOBS
 7 XQT NSURF
```

DASHED LINE INDICATES NEW PAGE

```
 JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
  VALUE  28  8  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  1  4          ALFA=    .00  MACHNO= .0000  ALTITUDE=******       1


 $INPUT
 KOUT    =              +6,
 KT1     =              +1,
 KT2     =              +8,
 KT3     =              +3,
 LINX    =             +56,
 NWING   =              +2,
 NVTAIL  =              -2,
 NFUS    =              +1,
 COLOCP  =     .75000000E+00,
 CUTOF1  =     .10000000E-03,
 CUTOF2  =     .29000000E-02,
 LFLAP   =              +0,
 GSCALE  =     .10000000E+01,
 NSS     =              +3,                 +5,                 +7,                 +9,
      +12,
 NCS     =              +2,                 +2,                 +2,                 +2,
      +2,
 X       =     .30000000E+02,     .30000000E+02,     .30000000E+02,
  .15000000E+03,     .15000000E+03,    -.50000000E+02,    -.50000000E+02,
  .15000000E+03,     .15000000E+03,    -.30000000E+02,    -.30000000E+02,
 -.30000000E+02,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 Y       =     .00000000E+00,     .40000000E+02,     .14000000E+03,
  .00000000E+00,     .40000000E+02,     .00000000E+00,     .00000000E+00,
  .40000000E+02,     .40000000E+02,     .40000000E+02,     .40000000E+02,
  .40000000E+02,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 Z       =     .00000000E+00,     .00000000E+00,    -.17633000E+02,
 -.20000000E+02,    -.20000000E+02,     .00000000E+00,    -.20000000E+02,
 -.10000000E+02,    -.40000000E+02,     .10000000E+02,     .00000000E+00,
 -.10000000E+02,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 E       =     .40000000E+01,     .40000000E+01,    -.10000000E+01,
 -.20000000E+01,    -.20000000E+01,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 C       =     .40000000E+02,     .40000000E+02,     .10000000E+02,
  .30000000E+02,     .20000000E+02,     .80000000E+02,     .20000000E+03,
  .25000000E+02,     .10000000E+02,     .30000000E+02,     .60000000E+02,
  .60000000E+02,     .00000000E+00,     .00000000E+00,     .00000000E+00,
```

ORIGINAL PAGE IS OF POOR QUALITY

```
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,
     XOC      =      .00000000E+00,    .10000000E+01,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .10000000E+01,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .10000000E+01,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .10000000E+01,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .10000000E+01,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,
     ZDC      =      .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
      .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
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ORIGINAL PAGE IS
OF POOR QUALITY

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JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	28	8	2	3	2	4	3	4	4	6	1	1	0	1	0	0	0	1	1	4

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE 2
ALFA= .00 MACHNO= .0000 ALTITUDE=******

LIFTING SURFACE NO= 1 ← *SURFACE # 1 = WING*
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
280.000	40.000	10.000	4.0000	-1.0000	8199.59	9.5615	29.284	32.681	56.591	5.489	-5.655

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	40.000	140.000	40.000	.000	-20.000	15.000	10.000	12.494	28	4	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	22.500	30.000	-1.000	-10.000	-12.494	10.000	3.000	.800
-127.388	-126.061	-15.175	15.818	19.364	30.000	-.303	-10.000	-12.494	14.182	4.255	1.135
-113.234	-112.122	-12.717	11.636	16.227	30.000	.394	-10.000	-12.494	18.364	5.509	1.469
-99.080	-98.182	-10.259	7.455	13.091	30.000	1.091	-10.000	-12.494	22.545	6.764	1.804
-84.926	-84.243	-7.801	3.273	9.955	30.000	1.788	-10.000	-12.494	26.727	8.018	2.138
-70.771	-70.304	-5.343	-.909	6.818	30.000	2.485	-10.000	-12.494	30.909	9.273	2.473
-56.617	-56.365	-2.886	-5.091	3.682	30.000	3.182	-10.000	-12.494	35.091	10.527	2.807
-42.463	-42.425	-.428	-9.272	.546	30.000	3.879	-10.000	-12.494	39.272	11.782	3.142
-28.309	-28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
-14.154	-14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
.000	.000	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
14.154	14.154	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
28.309	28.309	.000	-10.000	.000	30.000	4.000	.000	.000	40.000	12.000	3.200
42.463	42.425	-.428	-9.272	.546	30.000	3.879	10.000	12.494	39.272	11.782	3.142
56.617	56.365	-2.886	-5.091	3.682	30.000	3.182	10.000	12.494	35.091	10.527	2.807
70.771	70.304	-5.343	-.909	6.818	30.000	2.485	10.000	12.494	30.909	9.273	2.473
84.926	84.243	-7.801	3.273	9.955	30.000	1.788	10.000	12.494	26.727	8.018	2.138
99.080	98.182	-10.259	7.455	13.091	30.000	1.091	10.000	12.494	22.545	6.764	1.804
113.234	112.122	-12.717	11.636	16.227	30.000	.394	10.000	12.494	18.364	5.509	1.469
127.388	126.061	-15.175	15.818	19.364	30.000	-.303	10.000	12.494	14.182	4.255	1.135
141.543	140.000	-17.633	20.000	22.500	30.000	-1.000	10.000	12.494	10.000	3.000	.800

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	28	8	2	3	2	4	3	4	4	6	1	1	0	1	0	0	0	1	1	4

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE 3
ALFA= .00 MACHNO= .0000 ALTITUDE=******

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
		.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
30.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
30.0000	40.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
30.0000	140.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-1.350+02	-1.664+01	1.365+02	1.365+02	1.011+01	2.333+00	2.711+01
2	1	-1.251+02	-1.495+01	1.264+02	1.264+02	1.011+01	3.030+00	3.416+01
3	1	-1.151+02	-1.331+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	1	-1.052+02	-1.171+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	1	-9.520+01	-1.016+01	9.605+01	9.605+01	1.011+01	5.121+00	5.530+01
6	1	-8.524+01	-8.644+00	8.594+01	8.594+01	1.011+01	5.818+00	6.235+01
7	1	-7.528+01	-7.174+00	7.583+01	7.583+01	1.011+01	6.515+00	6.939+01
8	1	-6.533+01	-5.747+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	1	-5.537+01	-4.364+00	5.561+01	5.561+01	1.011+01	7.909+00	8.348+01
10	1	-4.541+01	-3.023+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	1	-3.538+01	-2.336+00	3.539+01	3.539+01	1.011+01	9.303+00	9.421+01
12	1	-2.528+01	-2.308+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	1	-1.517+01	-2.308+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	1	-5.055+00	-2.308+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
15	1	5.055+00	-2.308+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	1	1.517+01	-2.308+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	1	2.528+01	-2.308+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	1	3.538+01	-2.336+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	1	4.541+01	-3.023+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	1	5.537+01	-4.364+00	5.561+01	5.561+01	1.011+01	8.606+00	8.348+01
21	1	6.533+01	-5.747+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	1	7.528+01	-7.174+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	1	8.524+01	-8.644+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	1	9.520+01	-1.016+01	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	1	1.052+02	-1.171+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01
26	1	1.151+02	-1.331+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	1	1.251+02	-1.495+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	1	1.350+02	-1.664+01	1.365+02	1.365+02	1.011+01	3.030+00	2.711+01
1	2	-1.350+02	-1.667+01	1.365+02	1.365+02	1.011+01	2.333+00	2.711+01
2	2	-1.251+02	-1.497+01	1.264+02	1.264+02	1.011+01	3.030+00	3.416+01
3	2	-1.151+02	-1.329+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	2	-1.052+02	-1.165+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	2	-9.520+01	-1.004+01	9.605+01	9.605+01	1.011+01	5.121+00	5.530+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 4

J	K	Y	Z	WL	EW	DWL	DC	DS
6	2	-8.524+01	-8.455+00	8.594+01	8.594+01	1.011+01	5.818+00	6.235+01
7	2	-7.528+01	-6.905+00	7.583+01	7.583+01	1.011+01	6.515+00	6.939+01
8	2	-6.533+01	-5.385+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	2	-5.537+01	-3.896+00	5.561+01	5.561+01	1.011+01	7.909+00	8.348+01
10	2	-4.541+01	-2.438+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	2	-3.538+01	-1.686+00	3.539+01	3.539+01	1.011+01	9.303+00	9.421+01
12	2	-2.528+01	-1.655+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	2	-1.517+01	-1.655+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	2	-5.055+00	-1.655+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
15	2	5.055+00	-1.655+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	2	1.517+01	-1.655+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	2	2.528+01	-1.655+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	2	3.538+01	-1.686+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	2	4.541+01	-2.438+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	2	5.537+01	-3.896+00	5.561+01	5.561+01	1.011+01	8.606+00	8.348+01
21	2	6.533+01	-5.385+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	2	7.528+01	-6.505+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	2	8.524+01	-8.455+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	2	9.520+01	-1.004+01	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	2	1.052+02	-1.165+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01
26	2	1.151+02	-1.329+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	2	1.251+02	-1.497+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	2	1.350+02	-1.667+01	1.365+02	1.365+02	1.011+01	3.030+00	2.711+01
1	3	-1.350+02	-1.670+01	1.365+02	1.365+02	1.011+01	2.333+00	2.711+01
2	3	-1.251+02	-1.498+01	1.264+02	1.264+02	1.011+01	3.030+00	3.416+01
3	3	-1.151+02	-1.327+01	1.163+02	1.163+02	1.011+01	3.727+00	4.121+01
4	3	-1.052+02	-1.159+01	1.062+02	1.062+02	1.011+01	4.424+00	4.825+01
5	3	-9.520+01	-9.917+00	9.605+01	9.605+01	1.011+01	5.121+00	5.530+01
6	3	-8.524+01	-8.267+00	8.594+01	8.594+01	1.011+01	5.818+00	6.235+01
7	3	-7.528+01	-6.635+00	7.583+01	7.583+01	1.011+01	6.515+00	6.939+01
8	3	-6.533+01	-5.022+00	6.572+01	6.572+01	1.011+01	7.212+00	7.644+01
9	3	-5.537+01	-3.428+00	5.561+01	5.561+01	1.011+01	7.909+00	8.348+01
10	3	-4.541+01	-1.853+00	4.550+01	4.550+01	1.011+01	8.606+00	9.053+01
11	3	-3.538+01	-1.036+00	3.539+01	3.539+01	1.011+01	9.303+00	9.421+01
12	3	-2.528+01	-1.002+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
13	3	-1.517+01	-1.002+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
14	3	-5.055+00	-1.002+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
15	3	5.055+00	-1.002+00	5.055+00	5.055+00	1.011+01	9.333+00	9.436+01
16	3	1.517+01	-1.002+00	1.517+01	1.517+01	1.011+01	9.333+00	9.436+01
17	3	2.528+01	-1.002+00	2.528+01	2.528+01	1.011+01	9.333+00	9.436+01
18	3	3.538+01	-1.036+00	3.539+01	3.539+01	1.011+01	9.333+00	9.421+01
19	3	4.541+01	-1.853+00	4.550+01	4.550+01	1.011+01	9.303+00	9.053+01
20	3	5.537+01	-3.428+00	5.561+01	5.561+01	1.011+01	8.606+00	8.348+01
21	3	6.533+01	-5.022+00	6.572+01	6.572+01	1.011+01	7.909+00	7.644+01
22	3	7.528+01	-6.635+00	7.583+01	7.583+01	1.011+01	7.212+00	6.939+01
23	3	8.524+01	-8.267+00	8.594+01	8.594+01	1.011+01	6.515+00	6.235+01
24	3	9.520+01	-9.917+00	9.605+01	9.605+01	1.011+01	5.818+00	5.530+01
25	3	1.052+02	-1.159+01	1.062+02	1.062+02	1.011+01	5.121+00	4.825+01

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VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 5

J	K	Y	Z	WL	EW	DWL	DC	DS
26	3	1.151+02	-1.327+01	1.163+02	1.163+02	1.011+01	4.424+00	4.121+01
27	3	1.251+02	-1.498+01	1.264+02	1.264+02	1.011+01	3.727+00	3.416+01
28	3	1.350+02	-1.670+01	1.365+02	1.365+02	1.011+01	3.030+00	2.711+01
1	4	-1.350+02	-1.674+01	1.365+02	1.365+02	1.011+01	3.000+00	3.486+01
2	4	-1.251+02	-1.500+01	1.264+02	1.264+02	1.011+01	3.896+00	4.392+01
3	4	-1.151+02	-1.325+01	1.163+02	1.163+02	1.011+01	4.792+00	5.298+01
4	4	-1.052+02	-1.151+01	1.062+02	1.062+02	1.011+01	5.688+00	6.204+01

5	4	-9.520+01	-9.771+00	9.605+01	9.605+01	1.011+01	6.584+00	7.110+01
6	4	-8.524+01	-8.038+00	8.594+01	8.594+01	1.011+01	7.480+00	8.016+01
7	4	-7.528+01	-6.308+00	7.583+01	7.583+01	1.011+01	8.377+00	8.922+01
8	4	-6.533+01	-4.582+00	6.572+01	6.572+01	1.011+01	9.273+00	9.828+01
9	4	-5.537+01	-2.860+00	5.561+01	5.561+01	1.011+01	1.017+01	1.073+02
10	4	-4.541+01	-1.142+00	4.550+01	4.550+01	1.011+01	1.106+01	1.164+02
11	4	-3.538+01	-2.471-01	3.539+01	3.539+01	1.011+01	1.196+01	1.211+02
12	4	-2.528+01	-2.098-01	2.528+01	2.528+01	1.011+01	1.200+01	1.213+02
13	4	-1.517+01	-2.098-01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
14	4	-5.055+00	-2.098-01	5.055+00	5.055+00	1.011+01	1.200+01	1.213+02
15	4	5.055+00	-2.098-01	5.055+00	5.055+00	1.011+01	1.200+01	1.213+02
16	4	1.517+01	-2.098-01	1.517+01	1.517+01	1.011+01	1.200+01	1.213+02
17	4	2.528+01	-2.098-01	2.528+01	2.528+01	1.011+01	1.200+01	1.213+02
18	4	3.538+01	-2.471-01	3.539+01	3.539+01	1.011+01	1.200+01	1.211+02
19	4	4.541+01	-1.142+00	4.550+01	4.550+01	1.011+01	1.196+01	1.164+02
20	4	5.537+01	-2.860+00	5.561+01	5.561+01	1.011+01	1.106+01	1.073+02
21	4	6.533+01	-4.582+00	6.572+01	6.572+01	1.011+01	1.017+01	9.828+01
22	4	7.528+01	-6.308+00	7.583+01	7.583+01	1.011+01	9.273+00	8.922+01
23	4	8.524+01	-8.038+00	8.594+01	8.594+01	1.011+01	8.377+00	8.016+01
24	4	9.520+01	-9.771+00	9.605+01	9.605+01	1.011+01	7.480+00	7.110+01
25	4	1.052+02	-1.151+01	1.062+02	1.062+02	1.011+01	6.584+00	6.204+01
26	4	1.151+02	-1.325+01	1.163+02	1.163+02	1.011+01	5.688+00	5.298+01
27	4	1.251+02	-1.500+01	1.264+02	1.264+02	1.011+01	4.792+00	4.392+01
28	4	1.350+02	-1.674+01	1.365+02	1.365+02	1.011+01	3.896+00	3.486+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	2.058+01	-1.400+02	-1.747+01	-2.683-01	9.496-01	1.620-01	2.052+01	-1.350+02	-1.664+01	1.237-02	-1.647-01	9.863-01
2	1	1.777+01	-1.300+02	-1.577+01	-2.685-01	9.503-01	1.575-01	1.805+01	-1.251+02	-1.495+01	3.919-03	-1.624-01	9.867-01
3	1	1.496+01	-1.201+02	-1.412+01	-2.687-01	9.510-01	1.529-01	1.559+01	-1.151+02	-1.331+01	-4.580-03	-1.600-01	9.871-01
4	1	1.215+01	-1.101+02	-1.252+01	-2.689-01	9.517-01	1.483-01	1.313+01	-1.052+02	-1.171+01	-1.311-02	-1.576-01	9.874-01
5	1	9.332+00	-1.002+02	-1.097+01	-2.690-01	9.523-01	1.437-01	1.066+01	-9.520+01	-1.016+01	-2.166-02	-1.552-01	9.876-01
6	1	6.520+00	-9.022+01	-9.465+00	-2.692-01	9.530-01	1.392-01	8.197+00	-8.524+01	-8.644+00	-3.022-02	-1.528-01	9.878-01
7	1	3.707+00	-8.026+01	-8.011+00	-2.694-01	9.536-01	1.345-01	5.732+00	-7.528+01	-7.174+00	-3.879-02	-1.503-01	9.879-01
8	1	8.942-01	-7.030+01	-6.607+00	-2.696-01	9.542-01	1.299-01	3.268+00	-6.533+01	-5.747+00	-4.737-02	-1.479-01	9.879-01
9	1	-1.919+00	-6.035+01	-5.251+00	-2.697-01	9.548-01	1.253-01	8.038-01	-5.537+01	-4.364+00	-5.595-02	-1.454-01	9.878-01
10	1	-4.731+00	-5.039+01	-3.945+00	-2.699-01	9.553-01	1.206-01	-1.660+00	-4.541+01	-3.023+00	-6.454-02	-1.429-01	9.876-01
11	1	-7.544+00	-4.043+01	-2.688+00	-1.214-02	9.999-01	5.312-03	-2.946+00	-3.538+01	-2.336+00	-6.957-02	-6.144-03	9.976-01

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VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 6

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
12	1	-7.667+00	-3.033+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-2.528+01	-2.308+00	-6.976-02	0.000	9.976-01
13	1	-7.667+00	-2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-1.517+01	-2.308+00	-6.976-02	0.000	9.976-01
14	1	-7.667+00	-1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	-5.055+00	-2.308+00	-6.976-02	0.000	9.976-01
15	1	-7.667+00	1.907-06	-2.634+00	0.000	1.000+00	0.000	-3.000+00	5.055+00	-2.308+00	-6.976-02	0.000	9.976-01
16	1	-7.667+00	1.011+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	1.517+01	-2.308+00	-6.976-02	0.000	9.976-01
17	1	-7.667+00	2.022+01	-2.634+00	0.000	1.000+00	0.000	-3.000+00	2.528+01	-2.308+00	-6.976-02	0.000	9.976-01
18	1	-7.667+00	3.033+01	-2.634+00	1.214-02	9.999-01	-5.312-03	-2.946+00	3.538+01	-2.336+00	-6.957-02	6.144-03	9.976-01
19	1	-7.544+00	4.043+01	-2.688+00	2.699-01	9.553-01	-1.206-01	-1.660+00	4.541+01	-3.023+00	-6.454-02	1.429-01	9.876-01
20	1	-4.731+00	5.039+01	-3.945+00	2.697-01	9.548-01	-1.253-01	8.038-01	5.537+01	-4.364+00	-5.595-02	1.454-01	9.878-01
21	1	-1.919+00	6.035+01	-5.251+00	2.696-01	9.542-01	-1.299-01	3.268+00	6.533+01	-5.747+00	-4.737-02	1.479-01	9.879-01
22	1	8.942-01	7.030+01	-6.607+00	2.694-01	9.536-01	-1.345-01	5.732+00	7.528+01	-7.174+00	-3.879-02	1.503-01	9.879-01
23	1	3.707+00	8.026+01	-8.011+00	2.692-01	9.530-01	-1.392-01	8.197+00	8.524+01	-8.644+00	-3.022-02	1.528-01	9.878-01
24	1	6.520+00	9.022+01	-9.465+00	2.690-01	9.523-01	-1.437-01	1.066+01	9.520+01	-1.016+01	-2.166-02	1.552-01	9.876-01
25	1	9.332+00	1.002+02	-1.097+01	2.689-01	9.517-01	-1.483-01	1.313+01	1.052+02	-1.171+01	-1.311-02	1.576-01	9.874-01
26	1	1.215+01	1.101+02	-1.252+01	2.687-01	9.510-01	-1.529-01	1.559+01	1.151+02	-1.331+01	-4.580-03	1.600-01	9.871-01
27	1	1.496+01	1.201+02	-1.412+01	2.685-01	9.503-01	-1.575-01	1.805+01	1.251+02	-1.495+01	3.919-03	1.624-01	9.867-01
28	1	1.777+01	1.300+02	-1.577+01	2.683-01	9.496-01	-1.620-01	2.052+01	1.350+02	-1.664+01	1.237-02	1.647-01	9.863-01
1	2	2.292+01	-1.400+02	-1.751+01	-2.050-01	9.646-01	1.659-01	2.320+01	-1.350+02	-1.667+01	1.237-02	-1.670-01	9.859-01
2	2	2.080+01	-1.300+02	-1.580+01	-2.051-01	9.652-01	1.625-01	2.143+01	-1.251+02	-1.497+01	3.918-03	-1.652-01	9.863-01
3	2	1.869+01	-1.201+02	-1.412+01	-2.052-01	9.657-01	1.590-01	1.967+01	-1.151+02	-1.329+01	-4.578-03	-1.634-01	9.866-01
4	2	1.657+01	-1.101+02	-1.248+01	-2.053-01	9.663-01	1.555-01	1.790+01	-1.052+02	-1.165+01	-1.310-02	-1.616-01	9.868-01
5	2	1.445+01	-1.002+02	-1.088+01	-2.054-01	9.668-01	1.520-01	1.613+01	-9.520+01	-1.004+01	-2.164-02	-1.598-01	9.869-01
6	2	1.234+01	-9.022+01	-9.314+00	-2.056-01	9.673-01	1.485-01	1.436+01	-8.524+01	-8.455+00	-3.019-02	-1.579-01	9.870-01
7	2	1.022+01	-8.026+01	-7.785+00	-2.057-01	9.678-01	1.450-01	1.260+01	-7.528+01	-6.905+00	-3.875-02	-1.561-01	9.870-01
8	2	8.106+00	-7.030+01	-6.294+00	-2.058-01	9.683-01	1.415-01	1.083+01	-6.533+01	-5.385+00	-4.732-02	-1.542-01	9.869-01
9	2	5.990+00	-6.035+01	-4.839+00	-2.059-01	9.688-01	1.379-01	9.061+00	-5.537+01	-3.896+00	-5.589-02	-1.524-01	9.867-01
10	2	3.875+00	-5.039+01	-3.421+00	-2.060-01	9.693-01	1.344-01	7.294+00	-4.541+01	-2.438+00	-6.447-02	-1.505-01	9.865-01
11	2	1.759+00	-4.043+01	-2.041+00	-9.129-03	9.999-01	5.873-03	6.372+00	-3.538+01	-1.686+00	-6.957-02	-6.494-03	9.976-01
12	2	1.667+00	-3.033+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-2.528+01	-1.655+00	-6.976-02	0.000	9.976-01
13	2	1.667+00	-2.022+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-1.517+01	-1.655+00	-6.976-02	0.000	9.976-01
14	2	1.667+00	-1.011+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	-5.055+00	-1.655+00	-6.976-02	0.000	9.976-01
15	2	1.667+00	1.907-06	-1.981+00	0.000	1.000+00	0.000	6.333+00	5.055+00	-1.655+00	-6.976-02	0.000	9.976-01
16	2	1.667+00	1.011+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	1.517+01	-1.655+00	-6.976-02	0.000	9.976-01
17	2	1.667+00	2.022+01	-1.981+00	0.000	1.000+00	0.000	6.333+00	2.528+01	-1.655+00	-6.976-02	0.000	9.976-01
18	2	1.667+00	3.033+01	-1.981+00	9.129-03	9.999-01	-5.873-03	6.372+00	3.538+01	-1.686+00	-6.957-02	6.494-03	9.976-01
19	2	1.759+00	4.043+01	-2.041+00	2.060-01	9.693-01	-1.344-01	7.294+00	4.541+01	-2.438+00	-6.447-02	1.505-01	9.865-01
20	2	3.875+00	5.039+01	-3.421+00	2.059-01	9.688-01	-1.379-01	9.061+00	5.537+01	-3.896+00	-5.589-02	1.524-01	9.867-01
21	2	5.990+00	6.035+01	-4.839+00	2.058-01	9.683-01	-1.415-01	1.083+01	6.533+01	-5.385+00	-4.732-02	1.542-01	9.869-01
22	2	8.106+00	7.030+01	-6.294+00	2.057-01	9.678-01	-1.450-01	1.260+01	7.528+01	-6.905+00	-3.875-02	1.561-01	9.870-01
23	2	1.022+01	8.026+01	-7.785+00	2.056-01	9.673-01	-1.485-01	1.436+01	8.524+01	-8.455+00	-3.019-02	1.579-01	9.870-01
24	2	1.234+01	9.022+01	-9.314+00	2.054-01	9.668-01	-1.520-01	1.613+01	9.520+01	-1.004+01	-2.164-02	1.598-01	9.869-01
25	2	1.445+01	1.002+02	-1.088+01	2.053-01	9.663-01	-1.555-01	1.790+01	1.052+02	-1.165+01	-1.310-02	1.616-01	9.868-01
26	2	1.657+01	1.101+02	-1.248+01	2.052-01	9.657-01	-1.590-01	1.967+01	1.151+02	-1.329+01	-4.578-03	1.634-01	9.866-01
27	2	1.869+01	1.201+02	-1.412+01	2.051-01	9.652-01	-1.625-01	2.143+01	1.251+02	-1.497+01	3.918-03	1.652-01	9.863-01
28	2	2.080+01	1.300+02	-1.580+01	2.050-01	9.646-01	-1.659-01	2.320+01	1.350+02	-1.667+01	1.237-02	1.670-01	9.859-01
1	3	2.525+01	-1.400+02	-1.755+01	-1.390-01	9.757-01	1.692-01	2.588+01	-1.350+02	-1.670+01	1.236-02	-1.692-01	9.855-01
2	3	2.383+01	-1.300+02	-1.582+01	-1.391-01	9.761-01	1.669-01	2.481+01	-1.251+02	-1.498+01	3.916-03	-1.680-01	9.858-01
3	3	2.241+01	-1.201+02	-1.412+01	-1.392-01	9.765-01	1.645-01	2.374+01	-1.151+02	-1.327+01	-4.575-03	-1.668-01	9.860-01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 7

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
4	3	2.099+01	-1.101+02	-1.244+01	-1.392-01	9.769-01	1.622-01	2.267+01	-1.052+02	-1.159+01	-1.309-02	-1.656-01	9.861-01
5	3	1.957+01	-1.002+02	-1.079+01	-1.393-01	9.773-01	1.598-01	2.160+01	-9.520+01	-9.917+00	-2.162-02	-1.643-01	9.862-01
6	3	1.816+01	-9.022+01	-9.163+00	-1.393-01	9.777-01	1.574-01	2.053+01	-8.524+01	-8.267+00	-3.017-02	-1.631-01	9.861-01

7	3	1.674+01	-8.026+01	-7.559+00	-1.394-01	9.780-01	1.551-01	1.946+01	-7.528+01	-6.635+00	-3.872-02	-1.619-01	9.861-01
8	3	1.532+01	-7.030+01	-5.981+00	-1.394-01	9.784-01	1.527-01	1.839+01	-6.533+01	-5.022+00	-4.727-02	-1.606-01	9.859-01
9	3	1.390+01	-6.035+01	-4.427+00	-1.395-01	9.788-01	1.503-01	1.732+01	-5.537+01	-3.428+00	-5.583-02	-1.593-01	9.856-01
10	3	1.248+01	-5.039+01	-2.898+00	-1.395-01	9.791-01	1.479-01	1.625+01	-4.541+01	-1.853+00	-6.439-02	-1.580-01	9.853-01
11	3	1.106+01	-4.043+01	-1.394+00	-6.122-03	1.000+00	6.434-03	1.569+01	-3.538+01	-1.036+00	-6.957-02	-6.844-03	9.976-01
12	3	1.100+01	-3.033+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-2.528+01	-1.002+00	-6.976-02	0.000	9.976-01
13	3	1.100+01	-2.022+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-1.517+01	-1.002+00	-6.976-02	0.000	9.976-01
14	3	1.100+01	-1.011+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	-5.055+00	-1.002+00	-6.976-02	0.000	9.976-01
15	3	1.100+01	1.907-06	-1.329+00	0.000	1.000+00	0.000	1.567+01	5.055+00	-1.002+00	-6.976-02	0.000	9.976-01
16	3	1.100+01	1.011+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	1.517+01	-1.002+00	-6.976-02	0.000	9.976-01
17	3	1.100+01	2.022+01	-1.329+00	0.000	1.000+00	0.000	1.567+01	2.528+01	-1.002+00	-6.976-02	0.000	9.976-01
18	3	1.100+01	3.033+01	-1.329+00	6.122-03	1.000+00	-6.434-03	1.569+01	3.538+01	-1.036+00	-6.957-02	6.844-03	9.976-01
19	3	1.106+01	4.043+01	-1.394+00	1.395-01	9.791-01	-1.479-01	1.625+01	4.541+01	-1.853+00	-6.439-02	1.580-01	9.853-01
20	3	1.248+01	5.039+01	-2.898+00	1.395-01	9.788-01	-1.503-01	1.732+01	5.537+01	-3.428+00	-5.583-02	1.593-01	9.856-01
21	3	1.390+01	6.035+01	-4.427+00	1.394-01	9.784-01	-1.527-01	1.839+01	6.533+01	-5.022+00	-4.727-02	1.606-01	9.859-01
22	3	1.532+01	7.030+01	-5.981+00	1.394-01	9.780-01	-1.551-01	1.946+01	7.528+01	-6.635+00	-3.872-02	1.619-01	9.861-01
23	3	1.674+01	8.026+01	-7.559+00	1.393-01	9.777-01	-1.574-01	2.053+01	8.524+01	-8.267+00	-3.017-02	1.631-01	9.861-01
24	3	1.816+01	9.022+01	-9.163+00	1.393-01	9.773-01	-1.598-01	2.160+01	9.520+01	-9.917+00	-2.162-02	1.643-01	9.862-01
25	3	1.957+01	1.002+02	-1.079+01	1.392-01	9.769-01	-1.622-01	2.267+01	1.052+02	-1.159+01	-1.309-02	1.656-01	9.861-01
26	3	2.099+01	1.101+02	-1.244+01	1.392-01	9.765-01	-1.645-01	2.374+01	1.151+02	-1.327+01	-4.575-03	1.668-01	9.860-01
27	3	2.241+01	1.201+02	-1.412+01	1.391-01	9.761-01	-1.669-01	2.481+01	1.251+02	-1.498+01	3.916-03	1.680-01	9.858-01
28	3	2.383+01	1.300+02	-1.582+01	1.390-01	9.757-01	-1.692-01	2.588+01	1.350+02	-1.670+01	1.236-02	1.692-01	9.855-01
1	4	2.775+01	-1.400+02	-1.759+01	-6.634-02	9.829-01	1.720-01	2.914+01	-1.350+02	-1.674+01	1.236-02	-1.715-01	9.851-01
2	4	2.708+01	-1.300+02	-1.585+01	-6.636-02	9.831-01	1.708-01	2.891+01	-1.251+02	-1.500+01	3.914-03	-1.710-01	9.853-01
3	4	2.641+01	-1.201+02	-1.412+01	-6.637-02	9.833-01	1.697-01	2.869+01	-1.151+02	-1.325+01	-4.572-03	-1.704-01	9.854-01
4	4	2.573+01	-1.101+02	-1.240+01	-6.638-02	9.834-01	1.686-01	2.847+01	-1.052+02	-1.151+01	-1.308-02	-1.698-01	9.854-01
5	4	2.506+01	-1.002+02	-1.070+01	-6.640-02	9.836-01	1.675-01	2.824+01	-9.520+01	-9.771+00	-2.161-02	-1.692-01	9.853-01
6	4	2.439+01	-9.022+01	-9.001+00	-6.641-02	9.838-01	1.664-01	2.802+01	-8.524+01	-8.038+00	-3.014-02	-1.686-01	9.852-01
7	4	2.372+01	-8.026+01	-7.317+00	-6.642-02	9.840-01	1.652-01	2.779+01	-7.528+01	-6.308+00	-3.868-02	-1.680-01	9.850-01
8	4	2.305+01	-7.030+01	-5.645+00	-6.643-02	9.842-01	1.641-01	2.757+01	-6.533+01	-4.582+00	-4.722-02	-1.674-01	9.848-01
9	4	2.237+01	-6.035+01	-3.985+00	-6.645-02	9.844-01	1.630-01	2.735+01	-5.537+01	-2.860+00	-5.576-02	-1.667-01	9.844-01
10	4	2.170+01	-5.039+01	-2.337+00	-6.646-02	9.846-01	1.618-01	2.712+01	-4.541+01	-1.142+00	-6.431-02	-1.661-01	9.840-01
11	4	2.103+01	-4.043+01	-7.004-01	-2.900-03	1.000+00	7.035-03	2.700+01	-3.538+01	-2.471-01	-6.957-02	-7.219-03	9.976-01
12	4	2.100+01	-3.033+01	-6.293-01	0.000	1.000+00	0.000	2.700+01	-2.528+01	-2.098-01	-6.976-02	0.000	9.976-01
13	4	2.100+01	-2.022+01	-6.293-01	0.000	1.000+00	0.000	2.700+01	-1.517+01	-2.098-01	-6.976-02	0.000	9.976-01
14	4	2.100+01	-1.011+01	-6.293-01	0.000	1.000+00	0.000	2.700+01	-5.055+00	-2.098-01	-6.976-02	0.000	9.976-01
15	4	2.100+01	1.907-06	-6.293-01	0.000	1.000+00	0.000	2.700+01	5.055+00	-2.098-01	-6.976-02	0.000	9.976-01
16	4	2.100+01	1.011+01	-6.293-01	0.000	1.000+00	0.000	2.700+01	1.517+01	-2.098-01	-6.976-02	0.000	9.976-01
17	4	2.100+01	2.022+01	-6.293-01	0.000	1.000+00	0.000	2.700+01	2.528+01	-2.098-01	-6.976-02	0.000	9.976-01
18	4	2.100+01	3.033+01	-6.293-01	2.900-03	1.000+00	-7.035-03	2.700+01	3.538+01	-2.471-01	-6.957-02	7.219-03	9.976-01
19	4	2.103+01	4.043+01	-7.004-01	6.646-02	9.846-01	-1.618-01	2.712+01	4.541+01	-1.142+00	-6.431-02	1.661-01	9.840-01
20	4	2.170+01	5.039+01	-2.337+00	6.645-02	9.844-01	-1.630-01	2.735+01	5.537+01	-2.860+00	-5.576-02	1.667-01	9.844-01
21	4	2.237+01	6.035+01	-3.985+00	6.643-02	9.842-01	-1.641-01	2.757+01	6.533+01	-4.582+00	-4.722-02	1.674-01	9.848-01
22	4	2.305+01	7.030+01	-5.645+00	6.642-02	9.840-01	-1.652-01	2.779+01	7.528+01	-6.308+00	-3.868-02	1.680-01	9.850-01
23	4	2.372+01	8.026+01	-7.317+00	6.641-02	9.838-01	-1.664-01	2.802+01	8.524+01	-8.038+00	-3.014-02	1.686-01	9.852-01
24	4	2.439+01	9.022+01	-9.001+00	6.640-02	9.836-01	-1.675-01	2.824+01	9.520+01	-9.771+00	-2.161-02	1.692-01	9.853-01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4   ALFA= .00 MACHNO= .0000 ALTITUDE=******   8

J	K	XV	YV	ZV	LXV	LYV	LZV	XN	YN	ZN	LXN	LYN	LZN
25	4	2.506+01	1.002+02	-1.070+01	6.638-02	9.834-01	-1.686-01	2.847+01	1.052+02	-1.151+01	-1.308-02	1.698-01	9.854-01
26	4	2.573+01	1.101+02	-1.240+01	6.637-02	9.833-01	-1.697-01	2.869+01	1.151+02	-1.325+01	-4.572-03	1.704-01	9.854-01
27	4	2.641+01	1.201+02	-1.412+01	6.636-02	9.831-01	-1.708-01	2.891+01	1.251+02	-1.500+01	3.914-03	1.710-01	9.853-01
28	4	2.708+01	1.300+02	-1.585+01	6.634-02	9.829-01	-1.720-01	2.914+01	1.350+02	-1.674+01	1.236-02	1.715-01	9.851-01

(EOF PLOT FILE 1) *FILE # 1 = WING GEOMETRY*

SOLID LINE INDICATES THE OUTPUT HAS BEEN EDITED

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
VALUE 28 8 2 3 2 4 3 4 4 0 1 1 0 1 0 0 0 1 1 4   ALFA= .00 MACHNO= .0000 ALTITUDE=******   9

LIFTING SURFACE NO= 2 *SURFACE # 2 = HORIZONTAL TAIL*
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
80.000	30.000	20.000	-2.0000	-2.0000	2000.00	3.2000	25.000	25.333	16.667	131.000	-19.337

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	40.000	40.000	-30.000	.000	.000	.000	.000	10.620	8	3	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	3200.000	32.681	280.000

ORIGINAL PAGE IS
OF POOR QUALITY

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-40.000	-40.000	-20.000	130.000	135.000	150.000	-2.000	.000	-10.620	20.000	10.000	3.000
-36.000	-36.000	-20.000	129.000	134.250	150.000	-2.000	.000	-10.620	21.000	10.000	3.000
-32.000	-32.000	-20.000	128.000	133.500	150.000	-2.000	.000	-10.620	22.000	10.000	3.000
-28.000	-28.000	-20.000	127.000	132.750	150.000	-2.000	.000	-10.620	23.000	10.000	3.000
-24.000	-24.000	-20.000	126.000	132.000	150.000	-2.000	.000	-10.620	24.000	10.000	3.000
-20.000	-20.000	-20.000	125.000	131.250	150.000	-2.000	.000	-10.620	25.000	10.000	3.000
-16.000	-16.000	-20.000	124.000	130.500	150.000	-2.000	.000	-10.620	26.000	10.000	3.000
-12.000	-12.000	-20.000	123.000	129.750	150.000	-2.000	.000	-10.620	27.000	10.000	3.000
-8.000	-8.000	-20.000	122.000	129.000	150.000	-2.000	.000	-10.620	28.000	10.000	3.000
-4.000	-4.000	-20.000	121.000	128.250	150.000	-2.000	.000	-10.620	29.000	10.000	3.000
.000	.000	-20.000	120.000	127.500	150.000	-2.000	-.969	36.866	30.000	10.000	3.000
4.000	4.000	-20.000	121.000	128.250	150.000	-2.000	.000	10.620	29.000	10.000	3.000
8.000	8.000	-20.000	122.000	129.000	150.000	-2.000	.000	10.620	28.000	10.000	3.000
12.000	12.000	-20.000	123.000	129.750	150.000	-2.000	.000	10.620	27.000	10.000	3.000
16.000	16.000	-20.000	124.000	130.500	150.000	-2.000	.000	10.620	26.000	10.000	3.000
20.000	20.000	-20.000	125.000	131.250	150.000	-2.000	.000	10.620	25.000	10.000	3.000
24.000	24.000	-20.000	126.000	132.000	150.000	-2.000	.000	10.620	24.000	10.000	3.000
28.000	28.000	-20.000	127.000	132.750	150.000	-2.000	.000	10.620	23.000	10.000	3.000
32.000	32.000	-20.000	128.000	133.500	150.000	-2.000	.000	10.620	22.000	10.000	3.000
36.000	36.000	-20.000	129.000	134.250	150.000	-2.000	.000	10.620	21.000	10.000	3.000
40.000	40.000	-20.000	130.000	135.000	150.000	-2.000	.000	10.620	20.000	10.000	3.000

35	3	1.425+02	1.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	1.500+01	-1.991+01	3.490-02	0.000		9.994-01
36	3	1.425+02	2.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	2.500+01	-1.991+01	3.490-02	0.000		9.994-01
37	3	1.425+02	3.000+01	-1.974+01	0.000	1.000+00	0.000	1.475+02	3.500+01	-1.991+01	3.490-02	0.000		9.994-01

FILE # 2 = HORIZONTAL TAIL GEOMETRY

(EOF PLOT FILE 2)

OK TO IGNORE

* DIVIDE CHECK AT 026442

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	28	8	2	3	2	4	3	4	4	0	1	1	0	1	0	0	0	1	1	4

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE 12
ALFA= .00 MACHNO= .0000 ALTITUDE=******

SURFACE # 3 = FUSELAGE

LIFTING SURFACE NO= 3
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
.000	80.000	200.000	.0000	.0000	.06	.0000	.000	148.568	.000	-12.858	-11.428

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	89.999	56.310	2	4	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-20.000	.000	-20.000	-50.000	.000	150.000	.000	-89.999	-56.310	200.000	50.000	25.000
-18.000	.000	-18.000	-50.000	-3.000	138.000	.000	-89.999	-56.310	188.000	47.000	23.500
-16.000	.000	-16.000	-50.000	-6.000	126.000	.000	-89.999	-56.310	176.000	44.000	22.000
-14.000	.000	-14.000	-50.000	-9.000	114.000	.000	-89.999	-56.310	164.000	41.000	20.500
-12.000	.000	-12.000	-50.000	-12.000	102.000	.000	-89.999	-56.310	152.000	38.000	19.000
-10.000	.000	-10.000	-50.000	-15.000	90.000	.000	-89.999	-56.310	140.000	35.000	17.500
-8.000	.000	-8.000	-50.000	-18.000	78.000	.000	-89.999	-56.310	128.000	32.000	16.000
-6.000	.000	-6.000	-50.000	-21.000	66.000	.000	-89.999	-56.310	116.000	29.000	14.500
-4.000	.000	-4.000	-50.000	-24.000	54.000	.000	-89.999	-56.310	104.000	26.000	13.000
-2.000	.000	-2.000	-50.000	-27.000	42.000	.000	-89.999	-56.310	92.000	23.000	11.500
.000	.000	.000	-50.000	-30.000	30.000	.000	26.565	-74.835	80.000	20.000	10.000
2.000	.000	-2.000	-50.000	-27.000	42.000	.000	89.999	56.310	92.000	23.000	11.500
4.000	.000	-4.000	-50.000	-24.000	54.000	.000	89.999	56.310	104.000	26.000	13.000
6.000	.000	-6.000	-50.000	-21.000	66.000	.000	89.999	56.310	116.000	29.000	14.500
8.000	.000	-8.000	-50.000	-18.000	78.000	.000	89.999	56.310	128.000	32.000	16.000
10.000	.000	-10.000	-50.000	-15.000	90.000	.000	89.999	56.310	140.000	35.000	17.500
12.000	.000	-12.000	-50.000	-12.000	102.000	.000	89.999	56.310	152.000	38.000	19.000
14.000	.000	-14.000	-50.000	-9.000	114.000	.000	89.999	56.310	164.000	41.000	20.500
16.000	.000	-16.000	-50.000	-6.000	126.000	.000	89.999	56.310	176.000	44.000	22.000
18.000	.000	-18.000	-50.000	-3.000	138.000	.000	89.999	56.310	188.000	47.000	23.500
20.000	.000	-20.000	-50.000	.000	150.000	.000	89.999	56.310	200.000	50.000	25.000

39	4	1.125+02	0.000	-2.000+01	-9.796-01	0.000	2.009-01	8.125+01	0.000	-1.000+01	0.000	-1.000+00	0.000	
40	4	1.500+01	0.000	0.000	9.796-01	0.000	-2.009-01	8.125+01	0.000	-1.000+01	0.000	1.000+00	0.000	

FILE # 3 = FUSELAGE GEOMETRY

(EOF PLOT FILE 3)

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	28	8	2	3	2	4	3	4	4	0	1	1	0	1	0	0	0	1	1	4

EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE 14
ALFA= .00 MACHNO= .0000 ALTITUDE=******

SURFACE # 4 = VERTICAL FINS

LIFTING SURFACE NO= 4
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
30.000	25.000	10.000	.0000	.0000	525.00	1.7143	17.500	18.571	40.000	138.072	-22.857

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	30.000	30.000	30.000	.000	.000	.000	89.999	20.556	3	4	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	40.000	-10.000	125.000	131.250	150.000	.000	-14.036	72.560	25.000	12.500	2.500
1.500	40.000	-11.500	125.750	131.812	150.000	.000	89.999	20.556	24.250	12.125	2.425
3.000	40.000	-13.000	126.500	132.375	150.000	.000	89.999	20.556	23.500	11.750	2.350
4.500	40.000	-14.500	127.250	132.937	150.000	.000	89.999	20.556	22.750	11.375	2.275
6.000	40.000	-16.000	128.000	133.500	150.000	.000	89.999	20.556	22.000	11.000	2.200
7.500	40.000	-17.500	128.750	134.062	150.000	.000	89.999	20.556	21.250	10.625	2.125
9.000	40.000	-19.000	129.500	134.625	150.000	.000	89.999	20.556	20.500	10.250	2.050
10.500	40.000	-20.500	130.250	135.187	150.000	.000	89.999	20.556	19.750	9.875	1.975
12.000	40.000	-22.000	131.000	135.750	150.000	.000	89.999	20.556	19.000	9.500	1.900
13.500	40.000	-23.500	131.750	136.312	150.000	.000	89.999	20.556	18.250	9.125	1.825
15.000	40.000	-25.000	132.500	136.875	150.000	.000	89.999	20.556	17.500	8.750	1.750
16.500	40.000	-26.500	133.250	137.437	150.000	.000	89.999	20.556	16.750	8.375	1.675
18.000	40.000	-28.000	134.000	138.000	150.000	.000	89.999	20.556	16.000	8.000	1.600
19.500	40.000	-29.500	134.750	138.562	150.000	.000	89.999	20.556	15.250	7.625	1.525
21.000	40.000	-31.000	135.500	139.125	150.000	.000	89.999	20.556	14.500	7.250	1.450
22.500	40.000	-32.500	136.250	139.687	150.000	.000	89.999	20.556	13.750	6.875	1.375
24.000	40.000	-34.000	137.000	140.250	150.000	.000	89.999	20.556	13.000	6.500	1.300
25.500	40.000	-35.500	137.750	140.812	150.000	.000	89.999	20.556	12.250	6.125	1.225
27.000	40.000	-37.000	138.500	141.375	150.000	.000	89.999	20.556	11.500	5.750	1.150
28.500	40.000	-38.500	139.250	141.937	150.000	.000	89.999	20.556	10.750	5.375	1.075
30.000	40.000	-40.000	140.000	142.500	150.000	.000	89.999	20.556	10.000	5.000	1.000

D

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
 VALUE  28  8  2  3  2  4  3  4  4  0  1  1  0  1  0  0  0  1  1  4         ALFA=   .00  MACHNO= .000C  ALTITUDE=******        15

                         XA(1)/C   XA(2)/C   XA(3)/C   XA(4)/C   XA(5)/C   XA(6)/C   XA(7)/C   XA(8)/C   XA(9)/C  XA(10)/C

                           .0000    1.0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000

     X          Y        ZA(1)/C   ZA(2)/C   ZA(3)/C   ZA(4)/C   ZA(5)/C   ZA(6)/C   ZA(7)/C   ZA(8)/C   ZA(9)/C  ZA(10)/C

  150.0000   40.0000      .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000
  150.0000   40.0000      .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000     .0000


 J  K      Y          Z          WL         EW        DWL        DC         DS

42  1  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
43  1  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  1  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01

42  2  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
43  2  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  2  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01     INPUT SURFACE

42  3  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
43  3  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  3  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01

42  4  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  1.250+01  1.125+02
43  4  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  1.000+01  8.750+01
44  4  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  7.500+00  6.250+01
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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
 VALUE  28  8  2  3  2  4  3  4  4  0  1  1  0  1  0  0  0  1  1  4         ALFA=   .00  MACHNO= .000C  ALTITUDE=******        16

 J  K     XV         YV         ZV        IXV       IYV        IZV        XN         YN         ZN        IXN        IYN       IZN

44  4  1.444+02  4.000+01 -3.000+01  1.843-01  0.000     -9.829-01  1.484+02  4.000+01 -3.500+01  0.000      1.000+00  0.000
                        FILE # 4 =  LEFT VERTICAL FIN GEOMETRY
(EOF PLOT FILE  4)
 J  K      Y          Z          WL         EW        DWL        DC         DS

42  1 -4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
43  1 -4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  1 -4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01
46  1  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
47  1  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
48  1  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01

42  2 -4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
43  2 -4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  2 -4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01
46  2  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
47  2  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
48  2  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01
                                                                                 INPUT SURFACE + IMAGE SURFACE
42  3 -4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01        (NVTAIL MINUS)
43  3 -4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
44  3 -4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01
46  3  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  4.167+00  3.750+01
47  3  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  3.333+00  2.917+01
48  3  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  2.500+00  2.083+01

42  4 -4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  1.250+01  1.125+02
43  4 -4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  1.000+01  8.750+01
44  4 -4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  7.500+00  6.250+01
46  4  4.000+01 -1.500+01  5.000+00  4.325+02  1.000+01  1.250+01  1.125+02
47  4  4.000+01 -2.500+01  1.500+01  4.425+02  1.000+01  1.000+01  8.750+01
48  4  4.000+01 -3.500+01  2.500+01  4.525+02  1.000+01  7.500+00  6.250+01


 J  K     XV         YV         ZV        IXV       IYV        IZV        XN         YN         ZN        IXN        IYN       IZN

42  1  1.260+02 -4.000+01 -1.000+01  4.321-01  0.000     -9.018-01  1.303+02 -4.000+01 -1.500+01  0.000      1.000+00  0.000
43  1  1.308+02 -4.000+01 -2.000+01  4.321-01  0.000     -9.018-01  1.347+02 -4.000+01 -2.500+01  0.000      1.000+00  0.000
44  1  1.356+02 -4.000+01 -3.000+01  4.321-01  0.000     -9.018-01  1.391+02 -4.000+01 -3.500+01  0.000      1.000+00  0.000
46  1  1.260+02  4.000+01 -1.000+01  4.321-01  0.000     -9.018-01  1.303+02  4.000+01 -1.500+01  0.000      1.000+00  0.000
47  1  1.308+02  4.000+01 -2.000+01  4.321-01  0.000     -9.018-01  1.347+02  4.000+01 -2.500+01  0.000      1.000+00  0.000
48  1  1.356+02  4.000+01 -3.000+01  4.321-01  0.000     -9.018-01  1.391+02  4.000+01 -3.500+01  0.000      1.000+00  0.000
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43  2  [illegible]
44  2  1.381+02 -4.000+01 -3.000+01  3.680-01  0.000     -9.298-01  1.411+02 -4.000+01 -3.500+01  0.000      1.000+00  0.000
46  2  1.302+02  4.000+01 -1.000+01  3.680-01  0.000     -9.298-01  1.341+02  4.000+01 -1.500+01  0.000      1.000+00  0.000
47  2  1.342+02  4.000+01 -2.000+01  3.680-01  0.000     -9.298-01  1.376+02  4.000+01 -2.500+01  0.000      1.000+00  0.000
48  2  1.381+02  4.000+01 -3.000+01  3.680-01  0.000     -9.298-01  1.411+02  4.000+01 -3.500+01  0.000      1.000+00  0.000

42  3  1.344+02 -4.000+01 -1.000+01  2.983-01  0.000     -9.545-01  1.378+02 -4.000+01 -1.500+01  0.000      1.000+00  0.000
43  3  1.375+02 -4.000+01 -2.000+01  2.983-01  0.000     -9.545-01  1.405+02 -4.000+01 -2.500+01  0.000      1.000+00  0.000
44  3  1.406+02 -4.000+01 -3.000+01  2.983-01  0.000     -9.545-01  1.432+02 -4.000+01 -3.500+01  0.000      1.000+00  0.000
46  3  1.344+02  4.000+01 -1.000+01  2.983-01  0.000     -9.545-01  1.378+02  4.000+01 -1.500+01  0.000      1.000+00  0.000
47  3  1.375+02  4.000+01 -2.000+01  2.983-01  0.000     -9.545-01  1.405+02  4.000+01 -2.500+01  0.000      1.000+00  0.000
48  3  1.406+02  4.000+01 -3.000+01  2.983-01  0.000     -9.545-01  1.432+02  4.000+01 -3.500+01  0.000      1.000+00  0.000

42  4  1.406+02 -4.000+01 -1.000+01  1.843-01  0.000     -9.829-01  1.472+02 -4.000+01 -1.500+01  0.000      1.000+00  0.000
43  4  1.425+02 -4.000+01 -2.000+01  1.843-01  0.000     -9.829-01  1.478+02 -4.000+01 -2.500+01  0.000      1.000+00  0.000
44  4  1.444+02 -4.000+01 -3.000+01  1.843-01  0.000     -9.829-01  1.484+02 -4.000+01 -3.500+01  0.000      1.000+00  0.000
46  4  1.406+02  4.000+01 -1.000+01  1.843-01  0.000     -9.829-01  1.472+02  4.000+01 -1.500+01  0.000      1.000+00  0.000
47  4  1.425+02  4.000+01 -2.000+01  1.843-01  0.000     -9.829-01  1.478+02  4.000+01 -2.500+01  0.000      1.000+00  0.000
48  4  1.444+02  4.000+01 -3.000+01  1.843-01  0.000     -9.829-01  1.484+02  4.000+01 -3.500+01  0.000      1.000+00  0.000
                        FILE # 5 =  RIGHT VERTICAL FIN GEOMETRY (IMAGE)
(EOF PLOT FILE  5)
```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 18

SURFACE # 5 = ENGINE NACELLES

LIFTING SURFACE NO= 5
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	30.000	60.000	.0000	.0000	1050.00	.3810	52.500	54.285	40.000	-16.429	-.952

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	89.999	36.870	2	6	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	40.000	10.000	-30.000	-22.500	.000	.000	89.999	-73.142	30.000	7.500	3.750
1.000	40.000	9.000	-30.000	-21.750	3.000	.000	89.999	36.870	33.000	8.250	4.125
2.000	40.000	8.000	-30.000	-21.000	6.000	.000	89.999	36.870	36.000	9.000	4.500
3.000	40.000	7.000	-30.000	-20.250	9.000	.000	89.999	36.870	39.000	9.750	4.875
4.000	40.000	6.000	-30.000	-19.500	12.000	.000	89.999	36.870	42.000	10.500	5.250
5.000	40.000	5.000	-30.000	-18.750	15.000	.000	89.999	36.870	45.000	11.250	5.625
6.000	40.000	4.000	-30.000	-18.000	18.000	.000	89.999	36.870	48.000	12.000	6.000
7.000	40.000	3.000	-30.000	-17.250	21.000	.000	89.999	36.870	51.000	12.750	6.375
8.000	40.000	2.000	-30.000	-16.500	24.000	.000	89.999	36.870	54.000	13.500	6.750
9.000	40.000	1.000	-30.000	-15.750	27.000	.000	89.999	36.870	57.000	14.250	7.125
10.000	40.000	.000	-30.000	-15.000	30.000	.000	89.999	36.870	60.000	15.000	7.500
11.000	40.000	-1.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
12.000	40.000	-2.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
13.000	40.000	-3.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
14.000	40.000	-4.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
15.000	40.000	-5.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
16.000	40.000	-6.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
17.000	40.000	-7.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
18.000	40.000	-8.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
19.000	40.000	-9.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500
20.000	40.000	-10.000	-30.000	-15.000	30.000	.000	89.999	.000	60.000	15.000	7.500

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 20

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
50	5	-8.750+00	4.000+01	1.000+01	9.048-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	6	-3.750+00	4.000+01	1.000+01	9.345-01	0.000	-3.560-01	1.312+01	4.000+01	5.000+00	0.000	1.000+00	0.000
51	6	2.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

FILE # 6 = LEFT ENGINE NACELLE GEOMETRY

(EOF PLOT FILE 6)

J	K	Y	Z	WL	BM	DWL	DC	DS
50	1	-4.000+01	5.000+00	5.000+00	5.125+02	1.000+01	5.000+00	7.500+01
51	1	-4.000+01	-5.000+00	[illegible]	5.225+02	1.000+01	1.000+01	1.000+02

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 28 8 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 1 4 ALFA= .00 MACHNO= .0000 ALTITUDE=****** 21

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
53	1	-2.875+01	4.000+01	1.000+01	1.240-01	0.000	-9.923-01	-2.438+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	1	-2.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-2.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	2	-2.375+01	-4.000+01	1.000+01	5.300-01	0.000	-8.480-01	-1.688+01	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	2	-1.750+01	-4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	-4.000+01	-5.000+00	0.000	1.000+00	0.000
53	2	-2.375+01	4.000+01	1.000+01	5.300-01	0.000	-8.480-01	-1.688+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	2	-1.750+01	4.000+01	0.000	0.000	0.000	-1.000+00	-1.250+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	3	-1.875+01	-4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	3	-7.500+00	-4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	-4.000+01	-5.000+00	0.000	1.000+00	0.000
53	3	-1.875+01	4.000+01	1.000+01	7.474-01	0.000	-6.644-01	-9.375+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	3	-7.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	-2.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	4	-1.375+01	-4.000+01	1.000+01	8.517-01	0.000	-5.241-01	-1.875+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	4	2.500+00	-4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	-4.000+01	-5.000+00	0.000	1.000+00	0.000
53	4	-1.375+01	4.000+01	1.000+01	8.517-01	0.000	-5.241-01	-1.875+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	4	2.500+00	4.000+01	0.000	0.000	0.000	-1.000+00	7.500+00	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	5	-8.750+00	-4.000+01	1.000+01	9.048-01	0.000	-4.258-01	5.625+00	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	5	1.250+01	-4.000+01	0.000	0.000	0.000	-1.000+00	1.750+01	-4.000+01	-5.000+00	0.000	1.000+00	0.000
53	5	-8.750+00	4.000+01	1.000+01	9.048-01	0.000	-4.258-01	5.625+00	4.000+01	5.000+00	0.000	1.000+00	0.000
54	5	1.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	1.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000
50	6	-3.750+00	-4.000+01	1.000+01	9.345-01	0.000	-3.560-01	1.312+01	-4.000+01	5.000+00	0.000	1.000+00	0.000
51	6	2.250+01	-4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	-4.000+01	-5.000+00	0.000	1.000+00	0.000
53	6	-3.750+00	4.000+01	1.000+01	9.345-01	0.000	-3.560-01	1.312+01	4.000+01	5.000+00	0.000	1.000+00	0.000
54	6	2.250+01	4.000+01	0.000	0.000	0.000	-1.000+00	2.750+01	4.000+01	-5.000+00	0.000	1.000+00	0.000

FILE # 7 = RIGHT ENGINE NACELLE GEOMETRY (IMAGE)

(EOF PLOT FILE 7)

(NO VORTEX-LATTICE SOLUTIONS THIS TIME BECAUSE NSØLV = 12*0)

**** JOB TIME= 40 / ELAPSED TIME= 40 / NO.PLOT FILES= 7 / NSURF EXEC. VERSION 6-18-72 ****

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
 VALUE  14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4         ALFA=   .00  MACHNO= .0000  ALTITUDE=******         22

$INPUT
KOUT    =           +6,
KT1     =           +1,
KT2     =           +8,
KT3     =           +3,
LINX    =          +56,
NWING   =           +2, }
NVTAIL  =           +0, }   ONLY SURFACES # 1 AND 2, WING + TAIL ARE CONSIDERED NOW
NFUS    =           +0,
COLOCP  =     .75000000E+00,
CUTOF1  =     .10000000E-03,
CUTOF2  =     .29000000E-02,
LFLAP   =           +0,
GSCALE  =     .10000000E+01,
NSS     =           +3,              +5,              +7,              +9,
      +12,
NCS     =           +2,              +4,              +2,              +2,
      +2,
X       =     .30000000E+02,    .30000000E+02,    .30000000E+02,
 .15000000E+03,    .15000000E+03,    -.50000000E+02,    -.50000000E+02,
 .15000000E+03,    .15000000E+03,    -.30000000E+02,    -.30000000E+02,
-.30000000E+02,    .00000000E+00,    .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,     .00000000E+00
 .00000000E+00,    .00000000E+00,    .00000000E+00,     .0000
 .00000000E+00,    .00000000E+00,    .00000000E+00
 .00000000E+00,    .00000000E+00,    .000                    E+00,
Y       =     .00000000E+00,
 .00000000E+00,    .4000                   E+00,        .00000000E+00,
 .40000000E+02,
 .4000000                E+02,    .15000000E+02,     .00000000E+00,
                  .00000000E+00,    .00000000E+00,    .00000000E+00,
         E+00,    .00000000E+00,    .00000000E+00,
NFLG    =          +14,              +4,              +2,              +3,
        +2,           +4,              +3,              +4,
        +4,           +6,              +1,              +1,
        +0,           +1,              +0,              +0,
        +0,           +1,              +0,              +4,
NSOLV   =           +1,              +1,              +1,              +2,
        +0,           +0,              +0,              +0,
        +0,           +0,              +0,              +0,
$END
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ORIGINAL PAGE IS
OF POOR QUALITY

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
 VALUE  14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4         ALFA=   .00  MACHNO= .0000  ALTITUDE=******         23
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LIFTING SURFACE NO= 1 — *SURFACE # 1 = WING*

****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
280.000	40.000	10.000	4.0000	-1.0000	8199.59	9.5615	29.284	32.681	56.591	5.489	-5.655

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	40.000	140.000	30.000	.000	-20.000	15.000	10.000	12.494	14	4	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-141.543	-140.000	-17.633	20.000	22.500	30.000	-1.000	-10.000	-12.494	10.000	3.000	.800
-127.388	-126.061	-15.175	15.818	19.364	30.000	-.303	-10.000	-12.494	14.182	4.255	1.135
-113.234	-112.122	-12.717	11.636	16.227	30.000	.394	-10.000	-12.494	18.364	5.509	1.469

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP  PAGE
 VALUE  14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4         ALFA=   .00  MACHNO= .0000  ALTITUDE=******         27
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LIFTING SURFACE NO= 2 — *SURFACE # 2 = HORIZONTAL TAIL*

****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
80.000	30.000	20.000	-2.0000	-2.0000	2000.00	3.2000	25.000	25.333	18.667	131.000	-19.337

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	40.000	40.000	-10.000	.000	.000	.000	.000	10.620	4	3	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	8200.000	32.681	280.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-40.000	-40.000	-20.000	130.000	135.000	150.000	-2.000	.000	-10.620	20.000	10.000	3.000
-36.000	-36.000	-20.000	129.000	134.250	150.000	-2.000	.000	-10.620	21.000	10.000	3.000
-32.000	-32.000	-20.000	128.000	133.500	150.000	-2.000	.000	-10.620	22.000	10.000	3.000
-28.000	-28.000	-20.000	127.000	132.750	150.000	-2.000	.000	-10.620	23.000	10.000	3.000
-24.000	-24.000	-20.000	126.000	132.000	150.000	-2.000	.000	-10.620	24.000	10.000	3.000
-20.000	-20.000	-20.000	125.000	131.250	150.000	-2.000	.000	-10.620	25.000	10.000	3.000
-16.000	-16.000	-20.000	124.000	130.500	150.000	-2.000	.000	-10.620	26.000	10.000	3.000

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
VALUE   14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4          ALFA=   .00  MACHNO= .0000  ALTITUDE=******        29
```

NOTATION = 1/(1,1) INDICATES A SOLUTION FOR SURFACE # 1 IS OU: CONSIDERING SURFACE # 1 ONLY

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/(1, 1)
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.3527	.34119	-.05387	.95313	.00681	.04141	-.17854	-.4900+01
1	2	20.801	-130.043	-15.815	61.2737	1.7490	.05820	-.15014	.95501	.00755	-.01219	.11125	-.2596+01
1	3	23.831	-130.043	-15.836	61.2737	1.3456	.02500	-.16349	.97011	.01244	-.02245	.14417	-.2020+01
1	4	27.056	-130.011	-15.673	78.7805	1.4206	-.08275	-.19426	.95939	-.00291	-.05451	.24787	-.2750+01
2	1	12.145	-110.130	-12.544	89.4594	3.6325	.36292	-.04957	.96069	.01147	.04791	-.20024	-.7763+01
2	2	16.569	-110.130	-12.500	89.4594	1.8395	.04458	-.14618	.95622	.00767	-.01218	.12551	-.3991+01
2	3	20.994	-110.130	-12.456	89.4594	1.3923	.01126	-.16091	.97176	.01373	-.02528	.15789	-.3055+01
2	4	25.685	-110.066	-12.046	115.0192	1.4516	-.09578	-.17580	.95316	-.01031	-.06225	.26009	-.4114+01
3	1	6.520	-90.217	-9.490	117.6450	3.6836	.35231	-.04444	.96960	.01832	.05187	-.18846	-.1037+02
3	2	12.338	-90.217	-9.332	117.6450	1.8443	.02797	-.14298	.95842	.00863	-.01114	.14300	-.5268+01
3	3	18.156	-90.217	-9.175	117.6450	1.3934	-.00604	-.15867	.97241	.01407	-.02837	.17523	-.4023+01
3	4	24.326	-90.133	-8.530	151.2579	1.4599	-.11189	-.17427	.95098	-.01234	-.07074	.27510	-.5444+01
4	1	.894	-70.304	-6.631	145.8307	3.6999	.34018	-.03982	.98049	.02646	.05886	-.17482	-.1292+02
4	2	8.106	-70.304	-6.312	145.8307	1.8325	.01275	-.13974	.96273	.01119	-.00709	.15943	-.6496+01
4	3	15.318	-70.304	-5.993	145.8307	1.3765	-.02220	-.15653	.97496	.01600	-.02896	.19178	-.4930+01
4	4	22.967	-70.200	-5.060	187.4966	1.4587	-.12940	-.17317	.95062	-.01264	-.07727	.29190	-.6745+01
5	1	-4.731	-50.391	-3.969	174.0164	3.7010	.31920	-.03878	1.00180	.03905	.08887	-.14914	-.1544+02
5	2	3.875	-50.391	-3.440	174.0164	1.8367	-.00222	-.13817	.97988	.02102	.02520	.17948	-.7777+01
5	3	12.481	-50.391	-2.910	174.0164	1.3647	-.04057	-.15699	.99271	.02914	.00085	.21522	-.5837+01
5	4	21.551	-50.237	-1.473	223.7353	1.5111	-.15875	-.18925	.95198	-.00958	-.05840	.32466	-.8291+01
6	1	-7.605	-30.327	-2.661	188.4164	2.9548	.19307	-.00159	1.03889	.05375	.05764	-.01928	-.1377+02
6	2	1.713	-30.327	-2.011	188.4164	1.8781	-.05007	-.00323	1.02343	.03848	.03440	.22382	-.8753+01
6	3	11.031	-30.327	-1.361	188.4164	1.8211	-.07307	-.00357	1.04030	.05547	.01229	.24676	-.8488+01
6	4	20.707	-30.231	.631	242.2497	2.5312	-.27833	-.02616	.96685	-.01725	-.03472	.45125	-.1531+02
7	1	-7.667	-10.110	-2.634	188.7236	3.3639	.24995	.00000	1.03270	.04789	.00121	-.07631	-.1570+02
7	2	1.667	-10.110	-1.981	188.7236	1.9792	-.03493	.00000	1.01830	.03349	-.00063	.20857	-.9236+01
7	3	11.000	-10.110	-1.329	188.7236	1.7822	-.06998	.00000	1.04286	.05805	-.00232	.24363	-.8317+01

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
VALUE   14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4          ALFA= 10.00  MACHNO= .2000  ALTITUDE=******        30
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*ALTITUDE = ******** (OUT-OF-RANGE) INDICATES OUT-OF-GROUND SOLU*

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
7	4	20.598	-10.110	.871	242.6446	2.5103	-.28709	.00000	.95976	-.02505	-.00408	.46074	-.1506+02
8	1	-7.667	10.110	-2.634	188.7236	3.0956	.21128	.00000	1.03348	.04867	-.00887	-.03764	-.1445+02
8	2	1.667	10.110	-1.981	188.7236	1.9130	-.04119	.00000	1.02066	.03586	.01086	.21483	-.8927+01
8	3	11.000	10.110	-1.329	188.7236	1.7759	-.07342	.00000	1.04517	.06036	.03008	.24707	-.8287+01
8	4	20.598	10.110	.871	242.6447	2.5360	-.28774	.00000	.96247	-.02233	.05741	.46138	-.1522+02
9	1	-7.605	30.327	-2.661	188.4164	1.7018	.00832	.00273	1.04643	.06073	-.15159	.16573	-.7931+01
9	2	1.713	30.327	-2.011	188.4164	1.5863	-.08984	.00343	1.02816	.04292	-.09623	.26378	-.7393+01
9	3	11.031	30.327	-1.361	188.4164	1.9069	-.08257	.00356	1.02887	.04394	-.04469	.25636	-.8887+01
9	4	20.812	30.339	.151	242.2497	2.7306	-.27140	.07493	.97250	-.00857	.05019	.44222	-.1630+02
10	1	-4.731	50.391	-3.969	174.0164	4.1886	.46248	-.00276	.99352	.00629	-.17412	-.28819	-.1748+02
10	2	3.875	50.391	-3.440	174.0164	1.2275	.05866	.12210	.95762	-.01324	-.07832	.12412	-.5197+01
10	3	12.481	50.391	-2.910	174.0164	.0575	.01032	.14506	.96198	-.00576	-.02547	.16699	-.2460+00
10	4	21.623	50.327	-2.705	223.7354	-1.0120	.08627	.20403	.96674	.00579	-.00429	.08615	.5596+01
11	1	.894	70.304	-6.631	145.8307	2.7466	.29936	.04758	.95330	.00598	-.03044	-.13597	-.9593+01
11	2	8.106	70.304	-6.312	145.8307	.9028	.02562	.13365	.94006	-.00739	.02986	.14276	-.3200+01
11	3	15.318	70.304	-5.993	145.8307	.1729	.00992	.14861	.95370	-.00249	.05172	.15537	-.6194+00
11	4	22.906	70.166	-6.432	187.4966	-.8072	.14641	.14447	.96873	.00081	.03465	.01952	.3739+01
12	1	6.520	90.217	-9.490	117.6451	2.2243	.25439	.06858	.94589	.00274	-.01894	-.09057	-.6260+01
12	2	12.338	90.217	-9.332	117.6451	.7000	.03237	.13975	.94368	-.00392	.02380	.13648	-.2000+01
12	3	18.156	90.217	-9.175	117.6451	.0548	.02020	.15283	.95951	.00165	.03383	.14750	-.1583+00
12	4	24.277	90.106	-9.636	151.2579	-.9048	.16038	.14584	.96904	-.00002	.01263	.00876	.3380+01
13	1	12.145	110.130	-12.544	89.4594	1.8027	.22442	.08557	.94099	.00103	-.01156	-.06041	-.3852+01
13	2	16.569	110.130	-12.500	89.4594	.5268	.04149	.14521	.94626	-.00069	.02140	.12722	-.1143+01
13	3	20.994	110.130	-12.456	89.4594	-.0457	.03258	.15657	.96396	.00583	.02580	.13597	.1003+00
13	4	25.648	110.046	-12.888	115.0192	-.9786	.17458	.14715	.96912	-.00024	.00293	-.00416	.2779+01
14	1	17.771	130.043	-15.795	61.2737	1.4769	.20591	.09940	.93714	-.00036	-.00721	-.04189	-.2159+01
14	2	20.801	130.043	-15.815	61.2737	.3656	.05347	.14983	.94730	.00105	.01920	.11496	-.5428+00
14	3	23.831	130.043	-15.836	61.2737	-.1681	.04725	.15941	.96484	.00672	.02022	.12175	.2524+00
14	4	27.039	130.000	-16.102	78.7805	-1.0584	.18867	.13981	.96958	-.00095	-.00176	-.01755	.2057+01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1, 1)
****

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP   PAGE
VALUE   14  4  2  3  2  4  3  4  4  6  1  1  0  1  0  0  0  1  0  4          ALFA= 10.00  MACHNO= .2000  ALTITUDE=******        31
```

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
1	-.4644	-130.043	-15.805	131.433	1.8747	-.2683	1.8928	.2789	-.1718	.0878	.0830	.1551	-.9844
2	-.3933	-110.130	-12.522	111.212	1.9819	-.2948	2.0030	.2930	-.1648	.1356	.0961	.1349	-.9862

3	-.3222	-90.217	-9.411	50.992	2.0043	-.2704	2.0207	.3011	-.1616	.1800	.1117	.1208	-.9864
4	-.2511	-70.304	-6.472	70.771	2.0121	-.2422	2.0236	.3073	-.1573	.2234	.1284	.1067	-.9860
5	-.1800	-50.391	-3.704	50.551	2.0607	-.1946	2.0632	.3240	-.1654	.2718	.1599	.1465	-.9762
6	-.1083	-30.327	-2.336	30.331	2.3410	.1312	2.2827	.4273	-.3828	.3256	.2765	.0260	-.9606
7	-.0361	-10.110	-2.308	10.110	2.4373	.0652	2.3889	.4346	-.3557	.3413	.2866	.0000	-.9581
8	.0361	10.110	-2.308	10.110	2.3674	.1151	2.3115	.4311	-.3721	.3302	.2864	.0000	-.9581
9	.1083	30.327	-2.336	30.331	2.0505	.2890	1.9692	.4063	-.4763	.2809	.2681	-.0740	-.9606
10	.1800	50.391	-3.704	50.551	.9796	-.4496	1.0428	.0920	.3296	.1374	.0870	.2057	.9747
11	.2511	70.304	-6.472	70.771	.6223	-.1647	.6415	.0775	.2238	.0708	.1478	.1459	.9782
12	.3222	90.217	-9.411	90.992	.4004	-.0955	.4109	.0529	.2246	.0366	.1615	.1469	.9759
13	.3933	110.130	-12.522	111.212	.2207	-.0486	.2258	.0299	.2254	.0153	.1753	.1478	.9734
14	.4644	130.043	-15.805	131.433	.0590	-.0140	.0605	.0078	.2332	.0028	.1891	.1401	.9719

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1
****

E	FCN	ECX	FCY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
1	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*

*** AIRLOAD SUMS ***

AC	1.6858	-.0753	.0648	1.6733	.2186	-.1030	-.1375	-.0076	5.49	-5.66	8199.59	32.68	280.00
CG	1.6857	-.0753	.0648	1.6732	.2186	-.3992	-.1388	-.0063	.00	.00	8200.00	32.68	280.00
AC	.1404*	.1345*	.0037*	.1149*	.1568*	.0243*	-.0094*	.0092*	5.49*	-5.66*	8199.59*	32.68*	280.00*
CG	.1404*	.1344*	.0037*	.1149*	.1568*	.0240*	-.0095*	.0093*	.00*	.00*	8200.00*	32.68*	280.00*

* DETERMINANT= .1721+35 * SCALE= .4057-02 *

THE LIFT COEFFICIENT FOR THE WING ALONE, 1/(1,1), IS C_L *= 1.6732 WITH L.E. SUCTION (BLUNT L.E.)*
= 1.7881 NO L.E. SUCTION (SHARP L.E.)

NOTATION = 1/(1,2) INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOUSLY.

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/(1, 2)
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	17.771	-130.043	-15.795	61.2737	3.1425	.31837	-.07038	.95354	.00802	.03862	-.15499	-.4593+01
1	2	20.801	-130.043	-15.815	61.2737	1.6534	.05411	-.15123	.95632	.00875	-.01141	.11563	-.2454+01
1	3	23.831	-130.043	-15.836	61.2737	1.2875	.02272	-.16403	.97138	.01353	-.02097	.14675	-.1933+01
1	4	27.056	-130.011	-15.673	78.7805	1.3894	-.08469	-.19473	.96119	-.00124	-.05213	.25029	-.2690+01
2	1	12.145	-110.130	-12.544	89.4594	3.3616	.33326	-.05804	.96127	.01295	.04482	-.16955	-.7184+01
2	2	16.569	-110.130	-12.500	89.4594	1.7175	.03951	-.14761	.95838	.00952	-.01039	.13105	-.3727+01
2	3	20.994	-110.130	-12.456	89.4594	1.3184	.00832	-.16149	.97387	.01546	-.02226	.16141	-.2892+01
2	4	25.685	-110.066	-12.046	115.0192	1.4125	-.09848	-.17652	.95619	-.00756	-.05737	.26371	-.4003+01
3	1	6.520	-90.217	-9.490	117.6450	3.3530	.31651	-.05474	.97087	.02014	.05015	-.15115	-.9436+01
3	2	12.338	-90.217	-9.332	117.6450	1.6965	.02178	-.14486	.96210	.01146	-.00651	.15011	-.4846+01
3	3	18.156	-90.217	-9.175	117.6450	1.3052	-.00967	-.15976	.97597	.01674	-.02159	.18004	-.3769+01
3	4	24.326	-90.133	-8.530	151.2579	1.4156	-.11550	-.17528	.95533	-.00859	-.06081	.28052	-.5278+01
4	1	.894	-70.304	-6.631	145.8307	3.3054	.29793	-.05246	.98561	.02937	.06755	-.12933	-.1155+02
4	2	8.106	-70.304	-6.312	145.8307	1.6594	.00481	-.14261	.97073	.01588	.00967	.17011	-.5882+01
4	3	15.319	-70.304	-5.993	145.8307	1.2825	-.02760	-.15839	.98190	.02027	-.00915	.20042	-.4594+01
4	4	22.967	-70.200	-5.060	187.4966	1.4233	-.13463	-.17456	.95660	-.00816	-.05378	.30129	-.6581+01
5	1	-4.731	-50.391	-3.969	174.0164	3.0735	.22060	-.07095	1.03529	.05122	.16994	-.03546	-.1283+02
5	2	3.875	-50.391	-3.440	174.0164	1.7399	-.02271	-.14665	1.00926	.03140	.11899	.21380	-.7367+01
5	3	12.481	-50.391	-2.910	174.0164	1.3955	-.04723	-.16073	1.01103	.03501	.09099	.23575	-.5969+01
5	4	21.551	-50.237	-1.473	223.7353	1.5714	-.15479	-.19029	.95913	-.00789	.01769	.33482	-.8622+01

6	1	-7.605	-30.327	-2.661	188.4164	3.9243	.33613	-.00070	1.03018	.04427	.18413	-.16200	-.1829+02
6	2	1.713	-30.327	-2.011	188.4164	2.1643	-.02451	-.00309	1.01287	.02735	.15993	.19863	-.1009+02
6	3	11.031	-30.327	-1.361	188.4164	1.9240	-.06319	-.00352	1.03328	.04810	.12577	.23724	-.8967+01
6	4	20.707	-30.231	.631	242.2497	2.5434	-.27064	-.02594	.96082	-.02419	.04952	.44557	-.1538+02
7	1	-7.667	-10.110	-2.634	188.7236	4.7329	.42732	.00000	1.02377	.03896	.04678	-.25367	-.2209+02
7	2	1.667	-10.110	-1.981	188.7236	2.4835	-.00090	.00000	1.00259	.01779	.04444	.17455	-.1159+02
7	3	11.000	-10.110	-1.329	188.7236	2.0140	-.05192	.00000	1.03039	.04558	.03885	.22557	-.9399+01
7	4	20.598	-10.110	.871	242.6446	2.5658	-.27347	.00000	.94594	-.03887	.02672	.44712	-.1539+02
8	1	-7.667	10.110	-2.634	188.7236	4.5395	.40490	.00000	1.02298	.03818	-.06000	-.23126	-.2118+02
8	2	1.667	10.110	-1.981	198.7236	2.4184	-.00464	.00000	1.00421	.01940	-.03917	.17828	-.1129+02
8	3	11.000	10.110	-1.329	198.7236	1.9977	-.05550	.00000	1.03261	.04781	-.01502	.22915	-.9322+01
8	4	20.599	10.110	.871	242.6447	2.5856	-.27536	.00000	.94899	-.03581	.02470	.44901	-.1551+02
9	1	-7.605	30.327	-2.661	198.4164	2.4864	.12055	.00203	1.04000	.05349	-.28414	.05385	-.1159+02
9	2	1.713	30.327	-2.011	198.4164	1.8337	-.06992	.00331	1.01926	.03343	-.22668	.24423	-.8546+01
9	3	11.031	30.327	-1.361	189.4164	2.0084	-.07382	.00351	1.02224	.03695	-.16170	.24799	-.9360+01
9	4	20.812	30.339	.151	242.2497	2.7493	-.25802	.07435	.96841	-.01458	-.03993	.43522	-.1541+02
10	1	-4.731	50.391	-3.969	174.0164	3.6302	.37907	.02497	1.02369	.01616	-.25100	-.18991	-.1515+02
10	2	3.875	50.391	-3.440	174.0164	1.1086	.04230	.12928	.98401	-.00482	-.16684	.15344	-.4694+01
10	3	12.481	50.391	-2.910	174.0164	.0280	.00593	.14816	.97827	-.00128	-.11083	.18447	-.1199+00

10	4	21.623	50.327	-2.705	223.7354	-1.0585	.09538	.20498	.97367	.00802	-.08489	.09426	.5853+01
11	1	.894	70.304	-6.631	145.8307	2.3284	.25476	.06073	.95726	.00868	-.03558	-.08850	-.8133+01
11	2	8.106	70.304	-6.312	145.8307	.7175	.01733	.13650	.94737	-.00280	.01597	.15338	-.2543+01
11	3	15.318	70.304	-5.993	145.8307	.0672	.00482	.15045	.96079	.00225	.03417	.16334	-.2408+00
11	4	22.906	70.166	-6.432	187.4966	-.8666	.14342	.14527	.97242	.00329	.01610	.02551	.4014+01
12	1	6.520	90.217	-9.490	117.6451	1.8759	.21660	.07943	.94703	.00463	-.01646	-.05127	-.5279+01
12	2	12.338	90.217	-9.332	117.6451	.5447	.02590	.14172	.94753	-.00087	.01943	.14385	-.1556+01
12	3	18.156	90.217	-9.175	117.6451	-.0391	.01649	.15407	.96388	.00515	.02703	.15239	.1128+00
12	4	24.277	90.106	-9.636	151.2579	-.9576	.15765	.14637	.97117	.00164	.00549	.01269	.3577+01
13	1	12.145	110.130	-12.544	89.4594	1.5216	.19363	.09437	.94162	.00261	-.00829	-.02857	-.3252+01
13	2	16.569	110.130	-12.500	89.4594	.4001	.03624	.14672	.94864	.00139	.01956	.13294	-.8681+00
13	3	20.994	110.130	-12.456	99.4594	-.1229	.02957	.15748	.96681	.00829	.02261	.13959	.2697+00
13	4	25.648	110.046	-12.888	115.0192	-1.0216	.17225	.14750	.97028	.00071	-.00023	-.00127	.2901+01
14	1	17.771	130.043	-15.795	61.2737	1.2612	.18248	.10609	.93761	.00093	-.00436	-.01770	-.1843+01
14	2	20.801	130.043	-15.815	61.2737	.2675	.04927	.15097	.94875	.00238	.01835	.11947	-.3971+00
14	3	23.831	130.043	-15.836	61.2737	-.2280	.04493	.15003	.96654	.00823	.01860	.12440	.3423+00

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2090 ALTITUDE=****** 34

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
14	4	27.039	130.000	-16.102	76.7605	-1.0515	.18681	.14006	.97032	-.00030	-.00338	-.01540	.2121+01

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 2/(1, 2)
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
16	1	129.062	-30.000	-19.269	125.0000	-2.0648	-.15909	-.04257	1.01734	.02604	.13977	.33758	.6303+01
16	2	135.312	-30.000	-19.487	125.0000	-1.1296	-.00198	-.00352	1.01865	.02474	.14480	.17611	.3514+01
16	3	142.476	-30.000	-20.064	200.0000	-.9998	.07207	.01089	.95773	.01278	.14485	.10001	.4999+01
17	1	124.687	-10.000	-19.116	175.0000	-2.3959	-.20035	-.05144	.99651	.03078	.02060	.37890	.1024+02
17	2	133.437	-10.000	-19.422	175.0000	-1.2065	-.00572	-.00384	1.00975	.02718	.02335	.17946	.5255+01
17	3	142.462	-9.996	-20.172	200.0000	-1.0489	.08261	-.00000	.99736	.01255	.02330	.09104	.5243+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=****** 35

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
8	.0361	10.110	-2.308	10.110	2.8677	-.1868	2.8565	.4655	-.3274	.4081	.2787	.0000	-.9604
9	.1083	30.327	-2.336	30.331	2.3172	.2074	2.2460	.4384	-.4495	.3203	.2567	-.0740	-.9636
10	.1800	50.391	-3.704	50.551	.8315	-.3056	.8719	.0913	.3204	.1149	.0954	.2051	.9741
11	.2511	70.304	-6.472	70.771	.4477	-.1057	.4593	.0594	.2239	.0507	.1443	.1462	.9787
12	.3222	90.217	-9.411	90.992	.2510	-.0535	.2565	.0343	.2255	.0228	.1585	.1472	.9763
13	.3933	110.130	-12.522	111.212	.0993	-.0188	.1010	.0140	.2262	.0068	.1729	.1480	.9738
14	.4644	130.043	-15.805	131.433	-.0344	.0069	-.0351	-.0048	.2339	-.0016	.1872	.1403	.9722

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/(1, 2)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	IXL	IYL	IZL
16	-.3750	-30.000	-19.378	311.563	-1.3465	-.0598	-1.3157	-.2442	.1100	-.3700	.0720	.0109	.9973
17	-.1250	-10.000	-19.269	291.563	-1.5277	-.1234	-1.4831	-.2867	.1088	-.5098	.0825	-.0000	.9966
18	.1250	10.000	-19.269	291.563	-1.5890	-.1398	-1.5406	-.3002	.1024	-.5296	.0806	.0000	.9967
19	.3750	30.000	-19.378	211.563	-1.2446	-.0397	-1.2188	-.2230	.1079	-.3428	.0676	-.0109	.9977

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2
****

E	ECN	ECX	ECY	ECL	FCD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	1.7593	-.1156	.0667	1.7526	.1917	-.0474	-.1396	-.0077	5.49	-5.66	8199.59	32.68	280.00
1	.1401*	.1362*	.0029*	.1143*	.1585*	.0292*	-.0091*	.0089*	5.49*	-5.66*	8199.59*	32.68*	280.00*
2	-1.4401	-.0948	-.0002	-1.4018	-.3434	.1023	.0065	-.0012	131.00	-19.34	2000.00	25.33	80.00
2	-.0977*	.0948*	.0000*	-.1127*	.0764*	-.0257*	.0012*	.0012*	131.00*	-19.34*	2000.00*	25.33*	80.00*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO. 1 - MULTIPLE SURFACE ANALYSIS CAP PAGE
VALUE 14 4 2 3 2 4 3 4 4 6 1 1 0 1 0 0 0 1 0 4 ALFA= 10.00 MACHNO= .2000 ALTITUDE=****** 36

*** AIRLOAD SUMS ***

AC	1.4080	-.1387	.0667	1.4107	.1079	1.3113	-.1391	-.0078	5.49	-5.66	8199.59	32.68	280.00
CG	1.4080	-.1387	.0667	1.4107	.1079	1.0508	-.1405	-.0065	.00	.00	8200.00	32.68	280.00
AC	.1163*	.1593*	.0029*	.0868*	.1771*	.1255*	-.0090*	.0090*	5.49*	-5.66*	8199.59*	32.68*	280.00*
CG	.1163*	.1593*	.0029*	.0868*	.1771*	.1336*	-.0091*	.0090*	.00*	.00*	8200.00*	32.68*	280.00*

* DETERMINANT= .2376+13 * SCALE= .3941-02 *

END OF XQT NSURF

**** JOB TIME= 68 / ELAPSED TIME= 79 / NO.PLOT FILES= 7 / NSURF EXEC. VERSION 6-18-72 ****

****
****

```
XQT TRWPLT                                                    31 AUG 72          12*43*37.905
            KUNIT = 8
            ICCOMP= 0
            NTRAN = 0
            IPRINT= 0
            NTYPE = 0
            NOFSCL= 1
            ISCALY = 1,1,1,1,1,1,1,1,1,1
            NXL = 24
            NXR = 24
            NYL = 24
            NYH = 24
            NPOSN1 = 600, 950
            NPOSN2 = 600, 925
            NPOSN3 = 600, 900
            NPOSN4 = 600, 50
           ANNOT1 = ID = EXAMPLE PROB. 1 - MULTIPLE-SURFACE
           ANNOT2 = ID =   CAPABILITY DEMONSTRATION RUN
           ANNOT3 = ID =              A.GOMEZ/ 5 JULY 72
           ANNOT4 = ID =
            CHARSZ = 1.0,1.0,1.0,1.0
            TITLE = ID = ISOMETRIC PROJECTION OF LIFTING SURFACES
            XLABEL = ID = HORIZONTAL AXIS, SEMISPANS
            YLABEL = ID = VERTICAL AXIS  SEMISPANS
            XHI= 1.5
            XLO=-1.0
            YHI= 1.5
            YLO=-1.0
            PLOT = 2,1, 3,1, ENDLST
           ENDPLT
            ANOTSV = 0
            NOADV = 1
            PLOT = 5,1, 6,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,2, 3,2, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,3, 3,3, ENDLST
           ENDPLT
           ENDFIL

 MICROFILM PLOT COMPLETED
            NOADV = 1
            PLOT = 2,1, 3,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 5,1, 6,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,2, 3,2, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,3, 3,3, ENDLST
           ENDPLT
           ENDFIL
------------------------------------------------------------------------------------------

 MICROFILM PLOT COMPLETED
            NOADV = 1
            PLOT = 2,1, 3,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 5,1, 6,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,2, 3,2, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,3, 3,3, ENDLST
           ENDPLT
           ENDFIL

 MICROFILM PLOT COMPLETED
            NOADV = 1
            PLOT = 2,1, 3,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 5,1, 6,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,2, 3,2, ENDLST
           ENDPLT
            NOADV = 1

            NOADV = 1
            PLOT = 2,3, 3,3, ENDLST
           ENDPLT
           ENDFIL

 MICROFILM PLOT COMPLETED
            NOADV = 1
            PLOT = 2,1, 3,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 5,1, 6,1, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,2, 3,2, ENDLST
           ENDPLT
            NOADV = 1
            PLOT = 2,3, 3,3, ENDLST
           ENDPLT
           ENDFIL

 MICROFILM PLOT COMPLETED
           ENDRUN
```

START OF XQT TRWPLT (PLOT OPTION)

SOME OF THE OUTPUT OMITTED, SEE INPUT-DATA LISTING ON PAGES 6-1 AND 6-2.

6.3 EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY

```
                         SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B

                              TRW SYSTEMS INC., HOUSTON OPERATIONS

                                    HOUSTON, TEXAS (77058)

           **** JOBS INPUT LIST ****

 7 XQT ISURF
  EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION
  TASK 702, PROJECT 3303A, MJO 147035, AERODYNAMIC ANALYSIS AND DESIGN
  SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                       A.V.GOMEZ/ 5 JULY 1972
  $INPUT
  NSS=2, NCS=2, IFLG(2)=0,16,0, IFLG(5)=1,4,0, IFLG(8)=1, IFLG(10)=5,
  X=2*0.0, Y=0.0,30.0, Z=2*0.0, E=2*0.0, C=15.0,5.0, XCCR=0.25, XOC=0.0,1.0,
  WFLAP1=0., WFLAP2=0.625, WFLAP3=1.0, FLAPC=0.25, WSMOTH=0.25,
  PMECF=1, LDRAG=1, CLEANF=0.0035, NJOB=1, MACHN=0.2, ALFA=5, DELALF=-12.
  FLAPDJ=30.0, AILDJ=10.0,-15.0,
  KT2=8, IFLG(11)=4*1,
  NJOBL=9, WCL=1, 0.,0.25,0.5,0.75,1.0,1.25,1.5,1.75,2.0,
  $END
  $ENDJOBS
 7 XQT ISURF
---------------------------------------------------------------------------------------------------------

 JOBFLAG  1  2  3  4  5  6  7  8  9 10   EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION        PAGE
  VALUE   0  0 16  0  1  4  0  1  0  5   ALFA=****** MACHNO= .0000  FLAPD=   .00  AILERONU=   .00    .00  ALTITUDE=******    1

 $INPUT
 KOUT     =              +6,
 KT1      =              +1,
 KT2      =              +8,
 KT3      =              +0,
 LINX     =             +56,
 CULOCP   =      .75000000E+00,
 CUTOF1   =      .10000000E-03,
 CUTOF2   =      .29000000E-02,
 LFLAP    =              +0,
 LDRAG    =              +1,
 PMECF    =      .10000000E+01,
 DELALF   =     -.12000000E+02,
 NSS      =              +2,
 NCS      =              +2,
 X        =      .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 Y        =      .00000000E+00,     .30000000E+02,     .10000000E+04,
  .10000000E+04,     .10000000E+04,     .10000000E+04,     .10000000E+04,
  .10000000E+04,     .10000000E+04,     .10000000E+04,
 Z        =      .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 E        =      .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 C        =      .15000000E+02,     .50000000E+01,     .10000000E+03,
  .10000000E+03,     .10000000E+03,     .10000000E+03,     .10000000E+03,
  .10000000E+03,     .10000000E+03,     .10000000E+03,
 XOC      =      .00000000E+00,     .10000000E+01,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
 ZOC      =      .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
---------------------------------------------------------------------------------------------------------
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,
 XOCR     =      .25000000E+00,
 WFLAP1   =      .00000000E+00,
 WFLAP2   =      .62500000E+00,
 WFLAP3   =      .10000000E+01,
 FLAPC    =      .25000000E+00,
 WSMOTH   =      .25000000E+00,
 YSPAN    =      .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,     .00000000E+00,
  .00000000E+00,     .00000000E+00,     .00000000E+00,
```

```
NJOB    =              +1,
NJOBL   =              +9,
ALFA    =      .50000000E+01,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,
MACHN   =      .20000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
HEIGHT  =      .10000000E+05,    .10000000E+05,    .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,    .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,
FLAPDJ  =      .30000000E+02,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
AILDJ   =      .15000000E+02,   -.15000000E+02,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,
WCL     =      .10000000E+01,    .00000000E+00,    .25000000E+00,
 .50000000E+00,    .75000000E+00,    .10000000E+01,    .12500000E+01,
 .15000000E+01,    .17500000E+01,    .20000000E+01,    .50000000E+00,
 .60000000E+00,    .80000000E+00,    .90000000E+00,    .10000000E+01,
 .11000000E+01,    .12000000E+01,    .13000000E+01,    .14000000E+01,
 .15000000E+01,    .16000000E+01,
CLEANF  =      .35000000E-02,
IFLG    =              +0,              +0,              +16,             +0,
         +1,              +4,              +0,              +1,
         +0,              +5,              +1,              +1,
         +1,              +1,              +0,
$END
```

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 0 ALFA=****** MACHNO= .0000 FLAPD= .00 AILERDND= .00 .00 ALTITUDE=****** 2

WING GEOMETRY
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
60.000	15.000	5.000	.0000	.0000	600.00	6.0000	10.000	10.833	12.500	-.000	.000

FLAP SPAN1	FLAP SPAN2	FLAP CHORD	AILRN SPAN1	AILRN SPAN2	AILRN CHORD	DIHED 1/4MGC	SWEEP 1/4MGC	NO.SPAN VORTICES	NO.SPAN DISCONT	NO.CHORD VORTICES	NO.CHORD DISCONT
.000	.625	.2500	.625	30.000	.2500	.000	-.000	16	0	4	1

2Y/B	Y	XLE	X(1/4)	XHE	XTE	Z	E	SWEEP C/4	DIHED	C	CF
-1.000	-30.000	-1.250	.000	2.500	3.750	.000	.000	.000	.000	5.000	1.250
-.875	-26.250	-1.563	.000	3.125	4.688	.000	.000	.000	.000	6.250	1.563
-.750	-22.500	-1.875	.000	3.750	5.625	.000	.000	.000	.000	7.500	1.875
-.625	-18.750	-2.188	.000	4.375	6.563	.000	.000	.000	.000	8.750	2.188
-.500	-15.000	-2.500	.000	5.000	7.500	.000	.000	.000	.000	10.000	2.500
-.375	-11.250	-2.813	.000	5.625	8.438	.000	.000	.000	.000	11.250	2.813
-.250	-7.500	-3.125	.000	6.250	9.375	.000	.000	.000	.000	12.500	3.125
-.125	-3.750	-3.438	.000	6.875	10.312	.000	.000	.000	.000	13.750	3.438
.000	.000	-3.750	.000	7.500	11.250	.000	.000	.000	.000	15.000	3.750
.125	3.750	-3.438	.000	6.875	10.312	.000	.000	.000	.000	13.750	3.438
.250	7.500	-3.125	.000	6.250	9.375	.000	.000	.000	.000	12.500	3.125
.375	11.250	-2.813	.000	5.625	8.438	.000	.000	.000	.000	11.250	2.813
.500	15.000	-2.500	.000	5.000	7.500	.000	.000	.000	.000	10.000	2.500
.625	18.750	-2.188	.000	4.375	6.563	.000	.000	.000	.000	8.750	2.188
.750	22.500	-1.875	.000	3.750	5.625	.000	.000	.000	.000	7.500	1.875
.875	26.250	-1.563	.000	3.125	4.688	.000	.000	.000	.000	6.250	1.563
1.000	30.000	-1.250	.000	2.500	3.750	.000	.000	.000	.000	5.000	1.250

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	1.1000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

Y	2Y/B	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000								
30.0000	1.0000	.0000	.0000								

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA=****** MACHNO= .0000 FLAPD= .00 AILERDND= .00 .00 ALTITUDE=****** 3

J	K	Y	DY	DC	DS
1	1	-2.813+01	3.750+00	1.406+00	5.273+00
2	1	-2.437+01	3.750+00	1.719+00	6.445+00
3	1	-2.062+01	3.750+00	2.031+00	7.617+00
4	1	-1.687+01	3.750+00	2.344+00	8.789+00
5	1	-1.312+01	3.750+00	2.656+00	9.961+00
6	1	-9.375+00	3.750+00	2.969+00	1.113+01
7	1	-5.625+00	3.750+00	3.281+00	1.230+01
8	1	-1.875+00	3.750+00	3.594+00	1.348+01
9	1	1.875+00	3.750+00	3.594+00	1.348+01
10	1	5.625+00	3.750+00	3.281+00	1.230+01
11	1	9.375+00	3.750+00	2.969+00	1.113+01
12	1	1.312+01	3.750+00	2.656+00	9.961+00
13	1	1.687+01	3.750+00	2.344+00	8.789+00
14	1	2.062+01	3.750+00	2.031+00	7.617+00
15	1	2.437+01	3.750+00	1.719+00	6.445+00
16	1	2.813+01	3.750+00	1.406+00	5.273+00

1	2	-2.813+01	3.750+00	1.406+00	5.273+00
2	2	-2.437+01	3.750+00	1.719+00	6.445+00
3	2	-2.062+01	3.750+00	2.031+00	7.617+00
4	2	-1.687+01	3.750+00	2.344+00	8.789+00
5	2	-1.312+01	3.750+00	2.656+00	9.961+00
6	2	-9.375+00	3.750+00	2.969+00	1.113+01
7	2	-5.625+00	3.750+00	3.281+00	1.230+01
8	2	-1.875+00	3.750+00	3.594+00	1.348+01
9	2	1.875+00	3.750+00	3.594+00	1.348+01
10	2	5.625+00	3.750+00	3.281+00	1.230+01
11	2	9.375+00	3.750+00	2.969+00	1.113+01
12	2	1.312+01	3.750+00	2.656+00	9.961+00
13	2	1.687+01	3.750+00	2.344+00	8.789+00
14	2	2.062+01	3.750+00	2.031+00	7.617+00
15	2	2.437+01	3.750+00	1.719+00	6.445+00
16	2	2.813+01	3.750+00	1.406+00	5.273+00
1	3	-2.813+01	3.750+00	1.406+00	5.273+00
2	3	-2.437+01	3.750+00	1.719+00	6.445+00
3	3	-2.062+01	3.750+00	2.031+00	7.617+00
4	3	-1.687+01	3.750+00	2.344+00	8.789+00
5	3	-1.312+01	3.750+00	2.656+00	9.961+00
6	3	-9.375+00	3.750+00	2.969+00	1.113+01
7	3	-5.625+00	3.750+00	3.281+00	1.230+01
8	3	-1.875+00	3.750+00	3.594+00	1.348+01
9	3	1.875+00	3.750+00	3.594+00	1.348+01
10	3	5.625+00	3.750+00	3.281+00	1.230+01
11	3	9.375+00	3.750+00	2.969+00	1.113+01
12	3	1.312+01	3.750+00	2.656+00	9.961+00
13	3	1.687+01	3.750+00	2.344+00	8.789+00
14	3	2.062+01	3.750+00	2.031+00	7.617+00

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA=****** MACHNO= .0000 FLAPD= .00 AILEROND= .00 .00 ALTITUDE=****** 4

J	K	Y	DY	DC	DS
15	3	2.437+01	3.750+00	1.719+00	6.445+00
16	3	2.813+01	3.750+00	1.406+00	5.273+00
1	4	-2.813+01	3.750+00	1.406+00	5.273+00
2	4	-2.437+01	3.750+00	1.719+00	6.445+00
3	4	-2.062+01	3.750+00	2.031+00	7.617+00
4	4	-1.687+01	3.750+00	2.344+00	8.789+00
5	4	-1.312+01	3.750+00	2.656+00	9.961+00
6	4	-9.375+00	3.750+00	2.969+00	1.113+01
7	4	-5.625+00	3.750+00	3.281+00	1.230+01
8	4	-1.875+00	3.750+00	3.594+00	1.348+01
9	4	1.875+00	3.750+00	3.594+00	1.348+01
10	4	5.625+00	3.750+00	3.281+00	1.230+01
11	4	9.375+00	3.750+00	2.969+00	1.113+01
12	4	1.312+01	3.750+00	2.656+00	9.961+00
13	4	1.687+01	3.750+00	2.344+00	8.789+00
14	4	2.062+01	3.750+00	2.031+00	7.617+00
15	4	2.437+01	3.750+00	1.719+00	6.445+00
16	4	2.813+01	3.750+00	1.406+00	5.273+00

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-9.375-01	-3.000+01	0.000	-6.238-02	9.981-01	0.000	-3.516-01	-2.813+01	0.000	0.000	0.000	1.000+00
2	1	-1.172+00	-2.625+01	0.000	-6.238-02	9.981-01	0.000	-4.297-01	-2.437+01	0.000	0.000	0.000	1.000+00
3	1	-1.406+00	-2.250+01	0.000	-6.238-02	9.981-01	0.000	-5.078-01	-2.062+01	0.000	0.000	0.000	1.000+00
4	1	-1.641+00	-1.875+01	0.000	-6.238-02	9.981-01	0.000	-5.859-01	-1.687+01	0.000	0.000	0.000	1.000+00
5	1	-1.875+00	-1.500+01	0.000	-6.238-02	9.981-01	0.000	-6.641-01	-1.312+01	0.000	0.000	0.000	1.000+00
6	1	-2.109+00	-1.125+01	0.000	-6.238-02	9.981-01	0.000	-7.422-01	-9.375+00	0.000	0.000	0.000	1.000+00
7	1	-2.344+00	-7.500+00	0.000	-6.238-02	9.981-01	0.000	-8.203-01	-5.625+00	0.000	0.000	0.000	1.000+00
8	1	-2.578+00	-3.750+00	0.000	-6.238-02	9.981-01	0.000	-8.984-01	-1.875+00	0.000	0.000	0.000	1.000+00
9	1	-2.813+00	0.000	0.000	6.238-02	9.981-01	0.000	-8.984-01	1.875+00	0.000	0.000	0.000	1.000+00
10	1	-2.578+00	3.750+00	0.000	6.238-02	9.981-01	0.000	-8.203-01	5.625+00	0.000	0.000	0.000	1.000+00
11	1	-2.344+00	7.500+00	0.000	6.238-02	9.981-01	0.000	-7.422-01	9.375+00	0.000	0.000	0.000	1.000+00
12	1	-2.109+00	1.125+01	0.000	6.238-02	9.981-01	0.000	-6.641-01	1.312+01	0.000	0.000	0.000	1.000+00
13	1	-1.875+00	1.500+01	0.000	6.238-02	9.981-01	0.000	-5.859-01	1.687+01	0.000	0.000	0.000	1.000+00
14	1	-1.641+00	1.875+01	0.000	6.238-02	9.981-01	0.000	-5.078-01	2.062+01	0.000	0.000	0.000	1.000+00
15	1	-1.406+00	2.250+01	0.000	6.238-02	9.981-01	0.000	-4.297-01	2.437+01	0.000	0.000	0.000	1.000+00
16	1	-1.172+00	2.625+01	0.000	6.238-02	9.981-01	0.000	-3.516-01	2.813+01	0.000	0.000	0.000	1.000+00
1	2	3.125-01	-3.000+01	0.000	2.083-02	9.998-01	0.000	1.055+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	2	3.906-01	-2.625+01	0.000	2.083-02	9.998-01	0.000	1.289+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	2	4.688-01	-2.250+01	0.000	2.083-02	9.998-01	0.000	1.523+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	2	5.469-01	-1.875+01	0.000	2.083-02	9.998-01	0.000	1.758+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	2	6.250-01	-1.500+01	0.000	2.083-02	9.998-01	0.000	1.992+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	2	7.031-01	-1.125+01	0.000	2.083-02	9.998-01	0.000	2.227+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	2	7.813-01	-7.500+00	0.000	2.083-02	9.998-01	0.000	2.461+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	2	8.594-01	-3.750+00	0.000	2.083-02	9.998-01	0.000	2.695+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	2	9.375-01	0.000	0.000	[illegible]	9.998-01	0.000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	2	7.813-01	7.500+00	0.000	-2.083-02	9.998-01	0.000	2.227+00	9.375+00	0.000	0.000	0.000	1.000+00
12	2	7.031-01	1.125+01	0.000	-2.083-02	9.998-01	0.000	1.992+00	1.312+01	0.000	0.000	0.000	1.000+00
13	2	6.250-01	1.500+01	0.000	-2.083-02	9.998-01	0.000	1.758+00	1.687+01	0.000	0.000	0.000	1.000+00
14	2	5.469-01	1.875+01	0.000	-2.083-02	9.998-01	0.000	1.523+00	2.062+01	0.000	0.000	0.000	1.000+00
15	2	4.688-01	2.250+01	0.000	-2.083-02	9.998-01	0.000	1.289+00	2.437+01	0.000	0.000	0.000	1.000+00
16	2	3.906-01	2.625+01	0.000	-2.083-02	9.998-01	0.000	1.055+00	2.813+01	0.000	0.000	0.000	1.000+00
1	3	1.563+00	-3.000+01	0.000	1.036-01	9.946-01	0.000	2.461+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	3	1.953+00	-2.625+01	0.000	1.036-01	9.946-01	0.000	3.008+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	3	2.344+00	-2.250+01	0.000	1.036-01	9.946-01	0.000	3.555+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	3	2.734+00	-1.875+01	0.000	1.036-01	9.946-01	0.000	4.102+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	3	3.125+00	-1.500+01	0.000	1.036-01	9.946-01	0.000	4.648+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	3	3.516+00	-1.125+01	0.000	1.036-01	9.946-01	0.000	5.195+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	3	3.906+00	-7.500+00	0.000	1.036-01	9.946-01	0.000	5.742+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	3	4.297+00	-3.750+00	0.000	1.036-01	9.946-01	0.000	6.289+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	3	4.688+00	0.000	0.000	-1.036-01	9.946-01	0.000	6.289+00	1.875+00	0.000	0.000	0.000	1.000+00
10	3	4.297+00	3.750+00	0.000	-1.036-01	9.946-01	0.000	5.742+00	5.625+00	0.000	0.000	0.000	1.000+00
11	3	3.906+00	7.500+00	0.000	-1.036-01	9.946-01	0.000	5.195+00	9.375+00	0.000	0.000	0.000	1.000+00
12	3	3.516+00	1.125+01	0.000	-1.036-01	9.946-01	0.000	4.648+00	1.312+01	0.000	0.000	0.000	1.000+00
13	3	3.125+00	1.500+01	0.000	-1.036-01	9.946-01	0.000	4.102+00	1.687+01	0.000	0.000	0.000	1.000+00
14	3	2.734+00	1.875+01	0.000	-1.036-01	9.946-01	0.000	3.555+00	2.062+01	0.000	0.000	0.000	1.000+00
15	3	2.344+00	2.250+01	0.000	-1.036-01	9.946-01	0.000	3.008+00	2.437+01	0.000	0.000	0.000	1.000+00
16	3	1.953+00	2.625+01	0.000	-1.036-01	9.946-01	0.000	2.461+00	2.813+01	0.000	0.000	0.000	1.000+00

1	4	2.813+00	-3.000+01	0.000	1.843-01	9.829-01	0.000	3.867+00	-2.813+01	0.000	0.000	0.000	1.000+00
2	4	3.516+00	-2.625+01	0.000	1.843-01	9.829-01	0.000	4.727+00	-2.437+01	0.000	0.000	0.000	1.000+00
3	4	4.219+00	-2.250+01	0.000	1.843-01	9.829-01	0.000	5.586+00	-2.062+01	0.000	0.000	0.000	1.000+00
4	4	4.922+00	-1.875+01	0.000	1.843-01	9.829-01	0.000	6.445+00	-1.687+01	0.000	0.000	0.000	1.000+00
5	4	5.625+00	-1.500+01	0.000	1.843-01	9.829-01	0.000	7.305+00	-1.312+01	0.000	0.000	0.000	1.000+00
6	4	6.328+00	-1.125+01	0.000	1.843-01	9.829-01	0.000	8.164+00	-9.375+00	0.000	0.000	0.000	1.000+00
7	4	7.031+00	-7.500+00	0.000	1.843-01	9.829-01	0.000	9.023+00	-5.625+00	0.000	0.000	0.000	1.000+00
8	4	7.734+00	-3.750+00	0.000	1.843-01	9.829-01	0.000	9.883+00	-1.875+00	0.000	0.000	0.000	1.000+00
9	4	8.438+00	0.000	0.000	-1.843-01	9.829-01	0.000	9.883+00	1.875+00	0.000	0.000	0.000	1.000+00
10	4	7.734+00	3.750+00	0.000	-1.843-01	9.829-01	0.000	9.023+00	5.625+00	0.000	0.000	0.000	1.000+00
11	4	7.031+00	7.500+00	0.000	-1.843-01	9.829-01	0.000	8.164+00	9.375+00	0.000	0.000	0.000	1.000+00
12	4	6.328+00	1.125+01	0.000	-1.843-01	9.829-01	0.000	7.305+00	1.312+01	0.000	0.000	0.000	1.000+00
13	4	5.625+00	1.500+01	0.000	-1.843-01	9.829-01	0.000	6.445+00	1.687+01	0.000	0.000	0.000	1.000+00
14	4	4.922+00	1.875+01	0.000	-1.843-01	9.829-01	0.000	5.586+00	2.062+01	0.000	0.000	0.000	1.000+00
15	4	4.219+00	2.250+01	0.000	-1.843-01	9.829-01	0.000	4.727+00	2.437+01	0.000	0.000	0.000	1.000+00
16	4	3.516+00	2.625+01	0.000	-1.843-01	9.829-01	0.000	3.867+00	2.813+01	0.000	0.000	0.000	1.000+00

(EOF PLOT FILE 1) *FILE # 1 = PLANFORM AND ISOMETRIC PROJECTION OF WING GEOMETRY*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONO= 10.00-15.00 ALTITUDE=****** 6

LIFT DISTRIBUTION DETAIL
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J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-1.055	-28.125	.000	5.2734	1.3278	.18852	.01178	.99082	-.00340	-.00080	-.10174	-.9404+00
1	2	.352	-28.125	.000	5.2734	.3212	.03974	-.00083	.99334	-.00271	-.00383	.04741	-.2273+00
1	3	1.758	-28.125	.000	5.2734	-.0919	.03029	-.00315	.99150	-.00017	-.00811	.05670	.6482-01
1	4	3.155	-28.125	-.076	5.2734	-.6745	.10748	.02804	.97888	-.00176	-.00830	-.02180	.4762+00
2	1	-1.289	-24.375	.000	6.4453	1.9113	.27112	.01694	.98863	-.00604	.00645	-.18449	-.1658+01
2	2	.430	-24.375	.000	6.4453	.4738	.05538	-.00115	.99092	-.00508	-.00127	.03176	-.4108+00
2	3	2.148	-24.375	.000	6.4453	-.0975	.04019	-.00419	.99102	-.00091	-.01054	.04675	.8413-01
2	4	3.853	-24.375	-.111	6.4453	-.8292	.12703	.02447	.97830	-.00214	-.00716	-.04174	.7159+00
3	1	-1.523	-20.625	.000	7.6172	2.7622	.41890	.02618	.98731	-.01063	.05867	-.33256	-.2836+01
3	2	.508	-20.625	.000	7.6172	.6154	.07346	-.00153	.98927	-.00588	.03973	.01368	-.6317+00
3	3	2.539	-20.625	.000	7.6172	-.0922	.02438	-.00254	.98661	-.00223	.01929	.06264	.9435-01
3	4	4.565	-20.625	-.074	7.6172	-.5961	.05499	-.05006	.97736	-.00059	.00324	.03130	.6084+00
4	1	-1.758	-16.875	.000	8.7891	1.0438	.03108	.00194	1.00915	.00983	.08152	.05601	-.1210+01
4	2	.586	-16.875	.000	8.7891	1.0541	-.00785	.00016	1.00239	.00762	.05801	.09501	-.1232+01
4	3	2.930	-16.875	.000	8.7891	1.2399	-.00719	.00075	1.00092	.01391	.03621	.09439	-.1444+01
4	4	5.225	-16.875	.233	8.7891	1.7737	-.14609	-.09182	.97910	-.00308	-.02710	.23280	-.2084+01
5	1	-1.992	-13.125	.000	9.9609	1.4915	.08811	.00551	1.00628	.00940	.04241	-.00113	-.1846+01
5	2	.664	-13.125	.000	9.9609	1.1430	-.00355	.00007	1.00674	.01129	.02523	.09070	-.1508+01
5	3	3.320	-13.125	.000	9.9609	1.3289	-.02116	.00220	1.01754	.02737	.00497	.10843	-.1725+01
5	4	5.888	-13.125	.332	9.9609	2.1637	-.21901	-.05619	.97864	-.00911	-.05307	.30500	-.2886+01
6	1	-2.227	-9.375	.000	11.1328	1.6506	.13076	.00817	1.00433	.00822	.02996	-.04386	-.2435+01
6	2	.742	-9.375	.000	11.1328	1.1634	.00565	-.00012	1.00690	.01128	.01716	.08151	-.1715+01
6	3	3.711	-9.375	.000	11.1328	1.2685	-.02104	.00219	1.01875	.02820	.00125	.10830	-.1838+01
6	4	6.580	-9.375	.371	11.1328	2.1338	-.22464	-.05500	.97573	-.01001	-.04035	.31192	-.3190+01
7	1	-2.461	-5.625	.000	12.3047	1.6194	.12925	.00808	1.00469	.00840	.03291	-.04234	-.2639+01
7	2	.820	-5.625	.000	12.3047	1.1460	.00319	-.00007	1.00723	.01175	.02384	.08396	-.1866+01
7	3	4.102	-5.625	.000	12.3047	1.2550	-.02213	.00230	1.01816	.02870	.01185	.10940	-.2013+01
7	4	7.273	-5.625	.410	12.3047	2.1350	-.22167	-.05523	.97304	-.00957	-.02077	.31074	-.3538+01
8	1	-2.695	-1.875	.000	13.4766	1.3196	.06572	.00411	1.00625	.01089	.01800	.02131	-.2352+01
8	2	.898	-1.875	.000	13.4766	1.1612	.00027	-.00001	1.00834	.01265	.01376	.08688	-.2069+01
8	3	4.492	-1.875	.000	13.4766	1.3262	-.01313	.00137	1.01972	.02985	.00782	.10036	-.2324+01
8	4	7.966	-1.875	.449	13.4766	2.1708	-.21373	-.05659	.97380	-.00682	-.00857	.30380	-.3937+01
9	1	-2.695	1.875	.000	13.4766	1.3423	.06910	-.00432	1.00608	.01081	-.01657	.01792	-.2393+01
9	2	.898	1.875	.000	13.4766	1.1693	.00079	.00002	1.00824	.01257	-.01450	.08637	-.2083+01
9	3	4.492	1.875	.000	13.4766	1.3301	-.01294	-.00135	1.01933	.02978	-.01083	.10017	-.2332+01
9	4	7.966	1.875	.449	13.4766	2.1674	-.21245	.05662	.97198	-.00701	-.00163	.30346	-.3939+01

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONO= 10.00-15.00 ALTITUDE=****** 7

J	K	P(X)	P(Y)	P(Z)	AREA	CPA	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
10	1	-2.461	5.625	.000	12.3047	1.7209	.14060	-.00879	1.00433	.00811	-.03168	-.05372	-.2773+01
10	2	.820	5.625	.000	12.3047	1.1727	.00497	.00010	1.00692	.01146	-.02492	.08219	-.1910+01
10	3	4.102	5.625	.000	12.3047	1.2671	-.02129	-.00222	1.01754	.02845	-.01537	.10856	-.2032+01
10	4	7.273	5.625	.410	12.3047	2.1325	-.21944	.05530	.97062	-.01021	.00951	.30953	-.3543+01
11	1	-2.227	9.375	.000	11.1328	1.8310	.15552	-.00972	1.00361	.00758	-.02875	-.06867	-.2703+01
11	2	.742	9.375	.000	11.1328	1.2167	.01006	.00021	1.00622	.01063	-.01896	.07709	-.1795+01
11	3	3.711	9.375	.000	11.1328	1.2826	-.01862	-.00194	1.01768	.02764	-.00625	.10588	-.1861+01
11	4	6.580	9.375	.371	11.1328	2.1275	-.22111	.05524	.97216	-.01122	.02541	.30974	-.3193+01
12	1	-1.992	13.125	.000	9.9609	1.8064	.14688	-.00918	1.00410	.00775	-.03380	-.06001	-.2385+01
12	2	.664	13.125	.000	9.9609	1.2365	.00793	.00017	1.00573	.01920	-.02138	.07922	-.1635+01
12	3	3.320	13.125	.000	9.9609	1.3232	-.01734	-.00181	1.01693	.02686	-.00597	.10459	-.1719+01
12	4	5.888	13.125	.332	9.9609	2.1410	-.21810	.05584	.97340	-.01152	.03502	.30577	-.2972+01
13	1	-1.758	16.875	.000	8.7891	1.7364	.13505	-.00844	1.00483	.00730	-.05286	-.04816	-.2022+01
13	2	.586	16.875	.000	8.7891	1.2167	.00794	.00017	1.00315	.00796	-.03768	.07921	-.1421+01
13	3	2.930	16.875	.000	8.7891	1.2820	-.01102	-.00115	1.00827	.01976	-.02143	.09324	-.1482+01
13	4	5.209	16.875	.267	8.7891	1.9636	-.18703	.07143	.97411	-.00921	.02739	.27465	-.2321+01
14	1	-1.523	20.625	.000	7.6172	2.4351	.29150	-.01822	.99539	-.00146	-.04161	-.20491	-.2400+01
14	2	.508	20.625	.000	7.6172	1.0377	.04128	.00086	.99649	.00109	-.02813	.04586	-.1057+01
14	3	2.539	20.625	.000	7.6172	.7253	.01196	.00020	.99594	.00658	-.01385	.08519	-.7362+00
14	4	4.557	20.625	.114	7.6172	.9794	-.09707	.05259	.97774	-.00552	.02029	.18449	-.1001+01
15	1	-1.289	24.375	.000	6.4453	2.0224	.22491	-.01406	.99512	-.00005	-.01467	-.13819	-.1743+01
15	2	.430	24.375	.000	6.4453	.9460	.03329	.00069	.99626	.00038	-.00487	.05386	-.8149+00

15	3	2.148	24.375	.000	6.4453	.6917	.00864	.00090	.99439	.00294	.00605	.07847	-.5946+00
15	4	3.861	24.375	.075	6.4453	.8318	-.06429	.02005	.98029	-.00353	.02554	.15173	-.7167+00
16	1	-1.055	28.125	.000	5.2734	1.4994	.15883	-.00993	.99632	.00125	-.01310	-.07198	-.1056+01
16	2	.352	28.125	.000	5.2734	.7532	.02289	.00048	.99731	.00140	-.00333	.06426	-.5309+00
16	3	1.758	28.125	.000	5.2734	.5929	.00547	.00057	.99454	.00297	.00725	.08165	-.4169+00
16	4	3.160	28.125	.052	5.2734	.7185	-.05405	.02202	.98285	-.00088	.02528	.14133	-.5052+00

SECTION LIFT COEFFCIENTS
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J	2Y/B	Y	C	SCL	SCLC/B	DLIFT	SCM(C/4)	IXL	IYL	IZL
1	-.9375	-28.125	5.625	.2257	.0212	.0079	.1592	-.2090	.0035	-.9779
2	-.8125	-24.375	6.875	.5808	.0436	.0164	.2064	-.2882	-.0078	-.9575
3	-.6875	-20.625	8.125	.7348	.0995	.0373	.2109	-.4021	-.0351	-.9149
4	-.5625	-16.875	9.375	1.2801	.2000	.0750	-.3138	.0488	.0319	-.9983
5	-.4375	-13.125	10.625	1.5128	.2679	.1005	-.3603	.0650	.0188	-.9977

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NC. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=****** 8

J	2Y/B	Y	C	SCL	SCLC/B	DLIFT	SCM(C/4)	IXL	IYL	IZL
6	-.3125	-9.375	11.875	1.5560	.3080	.1155	-.3400	.0476	.0167	-.9987
7	-.1875	-5.625	13.125	1.5411	.3371	.1264	-.3403	.0489	.0171	-.9987
8	-.0625	-1.875	14.375	1.4982	.3590	.1346	-.3652	.0679	.0199	-.9975
9	.0625	1.875	14.375	1.5059	.3608	.1353	-.3641	.0660	-.0197	-.9976
10	.1875	5.625	13.125	1.5699	.3434	.1288	-.3375	.0422	-.0166	-.9990
11	.3125	9.375	11.875	1.6155	.3197	.1199	-.3326	.0327	-.0156	-.9993
12	.4375	13.125	10.625	1.6286	.2884	.1082	-.3392	.0351	-.0160	-.9993
13	.5625	16.875	9.375	1.5505	.2423	.0909	-.3139	.0239	-.0207	-.9995
14	.6875	20.625	8.125	1.3050	.1767	.0663	-.0965	-.1265	-.0018	-.9920
15	.8125	24.375	6.875	1.1281	.1293	.0485	-.0910	-.0975	.0023	-.9952
16	.9375	28.125	5.625	.8927	.0837	.0314	-.0888	-.0616	-.0005	-.9981

CHORDWISE PRESSURE DISTRIBUTION DETAIL
****

		* * * CHORD STATION (X-XLE)/C * * *										
		.00000	.10000	.20000	.30000	.40000	.50000	.60000	.70000	.80000	.90000	1.00000
2Y/B	SCL	* * * CHORD PRESSURE (CPL -CPU)*IZL * * *										
-.93750	.22394	.00000	1.14720	.69669	.35283	.16668	.03442	-.20002	-.52180	-.67879	-.46203	.00000
-.81250	.37276	.00000	1.65435	1.01255	.51954	.24824	.06495	-.23406	-.63718	-.83396	-.56809	.00000
-.68750	.69553	.00000	2.38186	1.42865	.68589	.26519	.04147	-.19268	-.47385	-.60139	-.40627	.00000
-.56250	1.26758	.00000	1.05079	1.06370	1.05704	1.03363	1.09592	1.37696	1.76307	1.79813	1.12427	.00000
-.43750	1.49499	.00000	1.36325	1.26074	1.15630	1.06851	1.13271	1.51927	2.07141	2.17831	1.37405	.00000
-.31250	1.54170	.00000	1.57340	1.37195	1.18521	1.04215	1.07802	1.45926	2.02268	2.14759	1.35966	.00000
-.18750	1.52661	.00000	1.54483	1.34563	1.16737	1.02616	1.06334	1.44846	2.01846	2.14869	1.36166	.00000
-.06250	1.47994	.00000	1.30167	1.24742	1.17273	1.08654	1.13702	1.51517	2.07175	2.18523	1.38017	.00000
.06250	1.48798	.00000	1.32153	1.26075	1.18122	1.09275	1.14208	1.51807	2.07118	2.18224	1.37772	.00000
.18750	1.55654	.00000	1.61646	1.39684	1.19584	1.04465	1.07727	1.45764	2.02099	2.14628	1.35896	.00000
.31250	1.60371	.00000	1.73140	1.47565	1.24273	1.07424	1.09775	1.46973	2.02303	2.14143	1.35431	.00000
.43750	1.61626	.00000	1.71431	1.47604	1.26257	1.10782	1.13857	1.50812	2.05038	2.15598	1.36009	.00000
.56250	1.54065	.00000	1.65218	1.45540	1.23849	1.09829	1.12230	1.44227	1.90889	1.98277	1.24683	.00000
.68750	1.30395	.00000	2.19345	1.58260	1.08733	.78122	.68276	.78758	.98184	.99991	.62768	.00000
.81250	1.12801	.00000	1.83631	1.36572	.98328	.74549	.66448	.73445	.86575	.85238	.52803	.00000
.93750	.89240	.00000	1.37075	1.04516	.77990	.61449	.56377	.63191	.74796	.73675	.45646	.00000

(EOF PLOT FILE 2) *FILE # 2 = CHORDWISE PRESSURE DISTRIBUTION*
(VORTEX-LATTICE SOLUTION)

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NC. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILEROND= 10.00-15.00 ALTITUDE=****** 9

SPANWISE SECTION LIFT DISTRIBUTION DETAIL
****

		WITH LE SUCTION			NO LE SUCTION			FLAP/AILERON		
Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCH
-30.000	-1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
-28.500	-.950000	.211350	-.050362	.157826	.255351	.021873	.169923	-.667522	.065703	.166881
-27.000	-.900000	.262320	-.021695	.163420	.304245	.027894	.174946	-.697576	.097773	.174394
-25.500	-.850000	.319920	-.035421	.179243	.379079	.034834	.195508	-.752306	.115413	.188077
-24.000	-.800000	.392975	-.099784	.218600	.513978	.043915	.251866	-.863516	.099693	.215879
-22.500	-.750000	.494723	-.201697	.264024	.712633	.057087	.323933	-.954174	.054842	.238544
-21.000	-.700000	.646929	-.245947	.238232	.919462	.077707	.313158	-.735714	.030169	.183928
-19.500	-.650000	.865756	-.144383	.072602	1.078728	.198538	.131153	.044270	.073504	-.011067
-18.000	-.600000	1.110079	.047716	-.166264	1.192642	.145766	-.143566	1.111887	.174742	-.277972
-16.500	-.550000	1.309547	.201715	-.342695	1.293113	.182199	-.347213	1.924460	.294011	-.481115
-15.000	-.500000	1.426180	.248366	-.387815	1.394953	.211302	-.396400	2.202364	.398997	-.550591
-13.500	-.450000	1.485347	.235034	-.363598	1.479298	.227870	-.365261	2.181211	.472546	-.545303
-12.000	-.400000	1.517628	.217699	-.349768	1.526280	.227974	-.338389	2.132749	.502063	-.533187
-10.500	-.350000	1.535604	.211044	-.335373	1.541010	.217465	-.333886	2.128010	.499477	-.532002
-9.000	-.300000	1.542580	.208599	-.335356	1.541399	.207196	-.335681	2.134788	.489267	-.533697
-7.500	-.250000	1.540784	.206796	-.333884	1.538536	.204129	-.334502	2.133996	.486293	-.533499
-6.000	-.200000	1.530501	.208099	-.334714	1.530064	.207580	-.334834	2.133683	.486540	-.533421
-4.500	-.150000	1.512358	.215063	-.342043	1.512993	.215817	-.341869	2.143509	.484450	-.535877
-3.000	-.100000	1.491912	.225136	-.353280	1.492323	.225626	-.353167	2.160066	.479888	-.540017
-1.500	-.050000	1.477241	.233156	-.362353	1.477140	.233037	-.362381	2.173242	.475508	-.543310
-.000	-.000000	1.474079	.235541	-.365161	1.473834	.235250	-.365228	2.176532	.473209	-.544133
1.500	.050000	1.483564	.231847	-.361480	1.483489	.231758	-.361501	2.170549	.473377	-.542637
3.000	.100000	1.505680	.222342	-.351891	1.505925	.222633	-.351824	2.157114	.476057	-.539278
4.500	.150000	1.534928	.210333	-.340097	1.535278	.210748	-.340001	2.141458	.479846	-.535365
6.000	.200000	1.563015	.200675	-.331385	1.562784	.200400	-.331449	2.130541	.482603	-.532635
7.500	.250000	1.584665	.195801	-.328312	1.583492	.194469	-.328635	2.127422	.483403	-.531856
9.000	.300000	1.600502	.193775	-.328111	1.599889	.193047	-.328280	2.127567	.483688	-.531892
10.500	.350000	1.611605	.192261	-.327940	1.614407	.195589	-.327170	2.126671	.484741	-.531668

12.000	.400000	1.617052	.193449	-.329650	1.621535	.198772	-.328417	2.130054	.484090	-.532514
13.500	.450000	1.614868	.201378	-.337417	1.611735	.197856	-.338279	2.147656	.477286	-.536914
15.000	.500000	1.599256	.209224	-.344630	1.583982	.190016	-.349077	2.149363	.455048	-.537341
16.500	.550000	1.557017	.186275	-.323678	1.548505	.176166	-.326018	2.027192	.358729	-.506798
18.000	.600000	1.477211	.100703	-.250488	1.520269	.157898	-.238651	1.688015	.253743	-.422004
19.500	.650000	1.375936	.003502	-.152782	1.490004	.138966	-.121422	1.245876	.170199	-.311469
21.000	.700000	1.283982	-.060714	-.084713	1.438798	.124210	-.041903	.927555	.080987	-.230139
22.500	.750000	1.212442	-.050627	-.072367	1.357426	.115552	-.032528	.819186	.051487	-.204797
24.000	.800000	1.146327	-.020610	-.087016	1.255644	.109213	-.056962	.828428	.053268	-.207107
25.500	.850000	1.065549	.007160	-.096447	1.144708	.101167	-.074684	.821118	.054492	-.205280
27.000	.900000	.569372	.016995	-.094144	1.029906	.090884	-.077502	.770320	.047431	-.192580
28.500	.950000	.866540	.023919	-.086750	.913453	.079632	-.073852	.730636	.026763	-.175159
30.000	1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000

(EOF PLOT FILE 31) *FILE # 3 = LIFT, INDUCED DRAG, AND PITCHING MOMENT SECTION COEFFICIENTS (VORTEX-LATTICE SOLUTION)*

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=****** 10

WING AIRLOAD COEFFICIENTS
****

	WCL	WCDI	WCMP	WCMR	WCMY	IXL	IYL	IZL	DELTA	SCALE
WITH LE SUCTION	1.32943	.13547	-.27156	.04229	-.00086	.014089	-.000498	-.999901	.4971+35	.1661-01
NO LE SUCTION	1.39743	.21596	-.25485	.04171	-.00028	.066015	.000000	-.997819		

* DIVIDE CHECK AT C41425
* DIVIDE CHECK AT C41425
OK TO IGNORE

LINEARIZED SOLUTION WITH LE SUCTION
****

ALFA	ALFAKO	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
5.000	-11.859	1.3294	.07886	.00022	.00004	.00005

Y	2Y/B	SCLA1	SCLB	SCL	SCM(1/4)
-30.000	-1.00000	.00000	.00000	.00000	.00000
-28.000	-.93333	.91864	-.99978	.23049	.15013
-26.000	-.86667	1.00414	-1.03309	.30184	.16816
-24.000	-.80000	1.00436	-1.01915	.39585	.21579
-22.000	-.73333	1.08552	-.90133	.54179	.25888
-20.000	-.66667	1.07702	-.64552	.70630	.12274
-18.000	-.60000	1.05506	-.29957	1.10305	-.19570
-16.000	-.53333	1.04112	-.03879	1.34531	-.39282
-14.000	-.46667	1.03895	.07693	1.45814	-.37730

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=****** 11

Y	2Y/B	SCLA1	SCLB	SCL	SCM(1/4)
-12.000	-.40000	1.03153	.13490	1.59624	-.33419
-10.000	-.33333	1.01472	.17854	1.52754	-.32886
-8.000	-.26667	.95550	.20737	1.53082	-.31640
-6.000	-.20000	.97205	.22677	1.51904	-.30483
-4.000	-.13333	.93928	.24520	1.49391	-.32902
-2.000	-.06667	.90861	.26150	1.46944	-.36917
-.000	-.00000	.80622	.27103	1.46249	-.38720
2.000	.06667	.90675	.27261	1.47807	-.37145
4.000	.13333	.93708	.26758	1.51337	-.32912
6.000	.20000	.96977	.26226	1.55150	-.30330
8.000	.26667	.97244	.25959	1.57897	-.31719
10.000	.33333	1.01131	.25239	1.59686	-.33131
12.000	.40000	1.02966	.23658	1.60544	-.32956
14.000	.46667	1.04202	.21469	1.59999	-.34663
16.000	.53333	1.05083	.16639	1.56339	-.35687
18.000	.60000	1.05785	.04786	1.46749	-.26597
20.000	.66667	1.05815	-.11108	1.33554	-.11839
22.000	.73333	1.09264	-.22383	1.22875	-.06490
24.000	.80000	1.06736	-.27817	1.14080	-.09538
26.000	.86667	1.00471	-.30617	1.02952	-.11147
28.000	.93333	.91814	-.32425	.89636	-.10768
30.000	1.00000	.00000	.00000	.00000	.00000

ORIGINAL PAGE IS
OF POOR QUALITY

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=****** 12

LINEARIZED SOLUTION WITH LE SUCTION
****

ALFA	ALFAKO	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
-11.859	-11.859	.0000	.07886	.00022	.00004	.00005

JOBFLAG 1 2 3 4 5 6 7 8 9 10 EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION PAGE
VALUE 1 0 16 0 1 4 0 1 0 4 ALFA= 5.00 MACHNO= .2000 FLAPD= 30.00 AILERONU= 10.00-15.00 ALTITUDE=****** 13

LINEARIZED SOLUTION WITH LE SUCTION
****

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JOBFLAG  1  2  3  4  5  6  7  8  9 10   EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION      PAGE
VALUE    1  0 16  0  1  4  0  1  0  4   ALFA=  5.00  MACHNO= .2000  FLAPD= 30.00  AILEROND= 10.00-15.00  ALTITUDE=******  16
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JOBFLAG  1  2  3  4  5  6  7  8  9 10   EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION      PAGE
VALUE    1  0 16  0  1  4  0  1  0  4   ALFA=  5.00  MACHNO= .2000  FLAPD= 30.00  AILEROND= 10.00-15.00  ALTITUDE=******  20
```

LINEARIZED SOLUTION WITH LE SUCTION
****

ALFA	ALFAK0	WCL	WCL SLOPE	CMP SLOPE	CMR SLOPE	CMY
13.503	-11.859	2.0000	.07886	.00022	.00004	.00005

		WITH LE SUCTION			NO LE SUCTION			FLAP/AILERON		
Y	2Y/B	SCL	SCDI	SCM(C/4)	SCL	SCDI	SCM(C/4)	FCN	FCX	FCH
-30.000	-1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
-28.000	-.933333	.846498	.038595	.161354	.948306	.179898	.189343	-.509958	.021626	.127490
-26.000	-.866667	.975183	.038255	.171091	1.091802	.201369	.203150	-.548887	.056085	.137222
-24.000	-.800000	1.109572	.060064	.216524	1.398895	.400929	.296068	-.662415	.028898	.165604
-22.000	-.733333	1.269711	.072117	.267835	1.861343	.753473	.430532	-.715877	-.039961	.178969
-20.000	-.666667	1.508509	.105459	.151275	2.100656	.783859	.314267	-.110440	.045348	.027610
-18.000	-.600000	1.810541	.165937	-.146758	2.003084	.388527	-.093422	1.157260	.358593	-.289315
-16.000	-.533333	2.043458	.223103	-.350218	1.965215	.136478	-.371362	2.039362	.663232	-.509841
-14.000	-.466667	2.154820	.250148	-.364573	2.115328	.205799	-.375333	2.173559	.844779	-.543390
-12.000	-.400000	2.197950	.267664	-.335930	2.219985	.292431	-.329923	2.109684	.908632	-.527421
-10.000	-.333333	2.207985	.287457	-.330483	2.215269	.295625	-.328498	2.106126	.900286	-.526531
-8.000	-.266667	2.198371	.305295	-.335216	2.192240	.298401	-.336887	2.128665	.891915	-.532166
-6.000	-.200000	2.170860	.322979	-.341592	2.169746	.321727	-.341896	2.143098	.853877	-.535774
-4.000	-.133333	2.123763	.344943	-.345769	2.125430	.346816	-.345315	2.126333	.882309	-.531583
-2.000	-.066667	2.078726	.364834	-.346873	2.078827	.364948	-.346845	2.093673	.863206	-.523418
-.000	-.000000	2.063465	.373843	-.345593	2.062856	.373147	-.345759	2.074288	.852506	-.518572
2.000	.066667	2.086115	.369606	-.344100	2.086180	.369683	-.344082	2.083681	.856071	-.520920
4.000	.133333	2.141754	.353343	-.343153	2.142637	.354385	-.342911	2.119630	.872627	-.529907
6.000	.200000	2.201798	.334845	-.337378	2.201248	.334192	-.337529	2.135381	.884108	-.533845
8.000	.266667	2.244474	.321662	-.325435	2.241490	.318140	-.326255	2.107132	.879660	-.526783
10.000	.333333	2.275009	.308962	-.318168	2.278538	.313152	-.317198	2.084673	.875953	-.521168
12.000	.400000	2.295901	.294100	-.321529	2.306565	.306765	-.318597	2.096136	.877257	-.524034
14.000	.466667	2.298736	.281354	-.329975	2.279681	.258726	-.335214	2.114841	.861008	-.528710
16.000	.533333	2.268043	.264734	-.316765	2.232036	.221972	-.326664	2.041261	.783673	-.510315
18.000	.600000	2.183553	.229374	-.236087	2.285982	.351015	-.207927	1.712967	.585816	-.428242
20.000	.666667	2.065214	.168694	-.122818	2.382999	.566088	-.035451	1.257704	.339441	-.314426
22.000	.733333	1.961440	.166992	-.072108	2.325266	.599061	.027916	1.015716	.212299	-.254929
24.000	.800000	1.856542	.166143	-.079648	2.116473	.474832	-.008186	.985184	.156913	-.246296
26.000	.866667	1.703253	.177347	-.086085	1.874422	.380624	-.039026	.942345	.187464	-.235586
28.000	.933333	1.512038	.167250	-.089875	1.634103	.332212	-.047316	.855400	.161215	-.213850
30.000	1.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000

```
WITH LE SUCTION   WCL=   2.00000 / WCDI=   .25831 / WCM(C/4)=   -.26917 / L/D=   7.74255
 NO LE SUCTION           2.18041 /         .42297 /             -.22422 /        5.15497
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JOBFLAG  1  2  3  4  5  6  7  8  9 10   EXAMPLE PROBLEM NO. 2 - SINGLE SURFACE ANALYSIS CAPABILITY DEMONSTRATION      PAGE
VALUE    1  0 16  0  1  4  0  1  0  4   ALFA=  5.00  MACHNO= .2000  FLAPD= 30.00  AILEROND= 10.00-15.00  ALTITUDE=******  21
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LINEARIZED SOLUTION WING COEFFICIENTS
****

	WITH LE SUCTION			NO LE SUCTION		
ALFA	WCL	WCD	WCM(C/4)	WCL	WCD	WCM(C/4)
-12.000	-.0112	.0156	-.2749	-.0322	.0299	-.2810
-11.000	.0677	.0162	-.2747	.0469	.0307	-.2808
-10.000	.1466	.0175	-.2744	.1266	.0326	-.2803
-9.000	.2254	.0196	-.2742	.2070	.0358	-.2797
-8.000	.3043	.0224	-.2740	.2879	.0402	-.2790
-7.000	.3831	.0260	-.2738	.3695	.0458	-.2780
-6.000	.4620	.0303	-.2735	.4517	.0526	-.2770
-5.000	.5408	.0354	-.2733	.5346	.0607	-.2757
-4.000	.6197	.0412	-.2731	.6181	.0700	-.2743
-3.000	.6986	.0478	-.2729	.7021	.0805	-.2728
-2.000	.7774	.0551	-.2726	.7869	.0922	-.2711
-1.000	.8563	.0632	-.2724	.8722	.1051	-.2692
.000	.9351	.0721	-.2722	.9582	.1193	-.2672
1.000	1.0140	.0817	-.2720	1.0448	.1347	-.2650
2.000	1.0929	.0920	-.2718	1.1320	.1513	-.2626
3.000	1.1717	.1032	-.2715	1.2198	.1691	-.2601
4.000	1.2506	.1150	-.2713	1.3083	.1881	-.2575
5.000	1.3294	.1276	-.2711	1.3974	.2084	-.2547
6.000	1.4083	.1410	-.2709	1.4872	.2299	-.2517
7.000	1.4871	.1551	-.2706	1.5775	.2526	-.2485
8.000	1.5660	.1700	-.2704	1.6685	.2765	-.2452
9.000	1.6449	.1856	-.2702	1.7601	.3016	-.2418
10.000	1.7237	.2020	-.2700	1.8523	.3280	-.2382
11.000	1.8026	.2191	-.2697	1.9452	.3556	-.2344
12.000	1.8814	.2370	-.2695	2.0387	.3844	-.2304
13.000	1.9603	.2556	-.2693	2.1328	.4144	-.2263
14.000	2.0392	.2750	-.2691	2.2275	.4456	-.2221
15.000	2.1180	.2952	-.2688	2.3229	.4781	-.2177
16.000	2.1969	.3161	-.2686	2.4189	.5118	-.2131
17.000	2.2757	.3377	-.2684	2.5155	.5467	-.2084
18.000	2.3546	.3601	-.2682	2.6127	.5828	-.2035

(EOF PLOT FILE 4) *FILE # 3 = LINEARIZED SOLUTION ARRAY (EXTRAPOLATED USING LIFTING-LINE THEORY)*

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**** JOB TIME= 133 / ELAPSED TIME= 133 / NO.PLOT FILES=   4 / ISURF EXEC. VERSION 6-18-72 ****

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XQT TRWPLT OUTPUT OMITTED, SEE INPUT LISTINGS (PAGE 6-3 THROUGH 6-5)

2

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                         SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B

                                  TRW SYSTEMS INC., HOUSTON OPERATIONS

                                        HOUSTON, TEXAS (77058)

             **** JOBS INPUT LIST ****

7 XQT NSURF
 EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AERODYNAMIC ANALYSIS
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO, HA010B (NSURF)
                                            A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=3,NVTAIL=-1, GSCALE=0,083333, COLOCP=0,80,
 MWING=1,
 NSS(1)=7,NCS(1)=2,NFLG(1)=22,NFLG(6)=6,XOC(1,1)=0.0,1,0,
 X(1)=-50.5,-50.5,-50.5,-50.5,3*0.0, XOCR(1)=7*1,0,
 Y(1)=0.,57.27,114.54,171.81,229.08,400,89,629.97,
 Z(1)=2*0.0,0.441,0.882,3*0.0,
 E(1)=2*0.0,-0,5,-1,0,-1,5,-3,0,-3,0,
 C(1)=1413.08,1261.518,1110.456,984.394,908.832,530.647,26.4,
 MCANRD=1
 NSS(2)=9,NCS(2)=3,NFLG(2)=6,NFLG(7)=2,XOC(1,2)=0.0,0.5,1,0,
 X(8)=-1723,0,-1723,0, XOCR(8)=0,55,0,31532,
 Y(8)=0.0,171.81,
 Z(8)=-73.0,-73,0,
 E(8)=2*3.0,
 C(8)=249.5,96,71,
 ZOC(1,8)=0,0,0,0,0,08816,
 ZOC(1,9)=0,0,0,0,0,08816,
 MFUS=1,
 NSS(3)=11,NCS(3)=2,NFLG(3)=2,NFLG(8)=3,XOC(1,3)=0,0,1,0,
 X(10)=-1463,08,-1312,018, Y(10)=0,,57,27, Z(10)=2*0.0,E(10)=2*0,0,
 C(10)=740,0,640,0,XOCR(10)=1,0,1.0,XOC(1,3)=0.,1.0,
 MFINS=1,
 NSS(4)=13, NCS(4)=2, NFLG(4)=3, NFLG(9)=2,  XOC(1,4)=0.0,1.0, XOCR(12)=2*1.0,
 X(12)=-50.5,36.0, Y(12)=2*171.81, Z(12)=0.882,-171.81, E(12)=-1,0,-1,0,
 C(12)=328.1313,83.07,
 XCG=-725.9, ZCG=5.5,YCG=0.0, REFS=906883,0, REFC=942,38, REFB=1260.0,
 NJOB=1, ALFA=1 , MACHN= 0.20, NSOLV=1,1,1,2,1,4,
 KT2= 8,        NFLG(19)= 1, 0,
 $END
 $ENDJOBS
7 XQT NSURF
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```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AERO0  PAGE
 VALUE  22  6  2  3  0  6  2  3  2  0  0  0  0  0  0  0  0  1  1  0          ALFA=   .00  MACHNO= .0000  ALTITUDE*******      1

$INPUT
KOUT     =               +6,
KT1      =               +1,
KT2      =               +8,
KT3      =               +3,
LINX     =              +56,
NWING    =               +3,
NVTAIL   =               -1,
NFUS     =               +0,
COLOCP   =     .80000000E+00,
CUTOF1   =     .10000000E-03,
CUTOF2   =     .29000000E-02,
LFLAP    =               +0,
GSCALE   =     .10000000E+01,
NSS      =               +7,               +9,               +11,               +13,
       +0,
NCS      =               +2,               +3,      [illegible]
       +0,
X        =    -.42083164E+01,    -.42083[illegible]    [illegible]    [illegible]00000E+00,
-.42083164E+01,    .00000[illegible]    [illegible]    .12500000E+00,
-.14358276E+0[illegible]    [illegible]    .12500000E+00,    .12500000E+00,
[illegible]    [illegible]00000E+00,    .12500000E+00,
    .10000000E+00,
XCG      =    -.60491424E+02,
YCG      =     .00000000E+00,
ZCG      =     .45833150E+00,
REFS     =     .62977481E+04,
REFC     =     .78531351E+02,
REFB     =     .10499958E+03,
NJOB     =               +1,
ALFA     =     .10000000E+02,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,
MACHN    =     .20000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
HEIGHT   =     .10000000E+05,    .10000000E+05,    .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,    .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,
FLAPDJ   =     .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,
TABDJ    =     .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,
AILDJ    =     .[illegible]0000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
NFLG     =               +22,               +6,               +2,               +3,
         +[illegible],       +6,               +2,               +3,
         +2,       +0,               +0,               +0,
         +0,       +0,               +0,               +0,
         +0,       +1,               +1,               +0,
NSOLV    =               +1,               +1,               +1,               +2,
         +1,       +4,               +0,               +0,
         +1,       +0,               +0,               +0,
$END
```

ORIGINAL PAGE IS
OF POOR QUALITY

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 2
ALFA= ,00 MACHNO= ,0000 ALTITUDE=******

LIFTING SURFACE NO= 1
****

SURFACE # 1 = WING

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
104.995	117,756	2.200	.0000	-3,0000	6196,66	1,7790	59,019	76,777	17,943	-59,772	,970

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	,600	1.000	.000	,000	,000	,000	.000	58,795	22	6	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
-60,491	,000	,458	6297,748	78,531	105,000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-52.498	-52,497	,000	-2,200	-1,650	,000	-3,000	.000	-58,795	2,200	,550	,275
-47.248	-47,247	.000	-13,756	-10,317	,000	-3,000	,000	-58,795	13,756	3,439	1,719
-41.999	-41,998	.000	-25,312	-18,984	,000	-3,000	,000	-58,795	25,312	6,328	3,164
-36.749	-36,748	.000	-36,867	-27,651	,000	-3,000	,000	-58,795	36,867	9,217	4,608
-31.499	-31,498	.000	-48,423	-36,317	,000	-2,800	,000	-58,795	48,423	12,106	6,053
-26.249	-26,248	.000	-59,979	-44,984	,000	-2,250	,000	-58,795	59,979	14,995	7,497
-20.999	-20,998	.000	-71,535	-53,651	,000	-1,700	,000	-58,795	71,535	17,884	8,942
-15.749	-15,749	,051	-83,090	-63,054	-2,946	-1,150	-,882	-61,878	80,144	20,036	10,018
-10.500	-10,499	.044	-94,645	-72,036	-4,208	-,600	,441	-58,795	90,437	22,609	11,309
-5.250	-5,250	.004	-108,075	-82,109	-4,208	-,050	,441	-63,185	103,867	25,967	12,983
.000	,000	.000	-121,965	-92,525	-4,208	,000	,000	63,260	117,756	29,439	14,720
5.250	5,250	.004	-108,075	-82,109	-4,208	-,050	-,441	63,185	103,867	25,967	12,983
10.500	10,499	,044	-94,645	-72,036	-4,208	-,600	-,441	58,795	90,437	22,609	11,309
15.749	15,749	.051	-83,090	-63,054	-2,946	-1,150	.882	61,878	80,144	20,036	10,018
20.999	20,998	.000	-71,535	-53,651	,000	-1,700	,000	58,795	71,535	17,884	8,942
26.249	26,248	.000	-59,979	-44,984	,000	-2,250	,000	58,795	59,979	14,995	7,497
31.499	31,498	.000	-48,423	-36,317	,000	-2,800	,000	58,795	48,423	12,106	6,053
36.749	36,748	.000	-36,867	-27,651	,000	-3,000	,000	58,795	36,867	9,217	4,608
41.999	41,998	,000	-25.312	-18,984	,000	-3,000	,000	58,795	25,312	6,328	3,164
47.248	47,247	.000	-13.756	-10,317	,000	-3,000	,000	58,795	13,756	3,439	1,719
52.498	52,497	.000	-2,200	-1,650	,000	-3,000	,000	58,795	2,200	,550	,275

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 3
ALFA= ,00 MACHNO= ,0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	,0000	,0000	,0000	.0000	.0000	.0000	,0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-4.2083	.0000	,0000	.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	.0000
-4.2083	4.7725	,0000	.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
-4.2083	9.5450	,0000	.0000	,0000	,0000	,0000	.0000	,0000	,0000	,0000	,0000
-4.2083	14.3174	,0000	.0000	,0000	,0000	.0000	.0000	,0000	,0000	,0000	,0000
.0000	19.0899	,0000	,0000	,0000	,0000	.0000	,0000	,0000	,0000	,0000	.0000
.0000	33.4074	,0000	,0000	,0000	,0000	,0000	.0000	,0000	,0000	,0000	.0000
.0000	52.4973	,0000	.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 1) *FILE # 1 = WING GEOMETRY*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 4
ALFA= ,00 MACHNO= ,0000 ALTITUDE=******

LIFTING SURFACE NO= 2
****

SURFACE # 2 = CANARD CONTROL SURFACE

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
28.635	20,792	8,059	3.0000	3,0000	413,07	1,9850	14,425	15,362	6,106	-147,385	-6,256

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	,600	1.000	.000	.000	,000	,000	.000	21.746	6	2	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
-60,491	,000	,458	6297,748	78,531	105,000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-14.317	-14,317	-6,083	-146,124	-144,109	-138,065	3,000	,000	-21,746	8,059	2,015	1,007
-12.886	-12,886	-6.083	-147,013	-144,680	-137,681	3,000	,000	-21,746	9,332	2,333	1,167
-11.454	-11,454	-6.083	-147,903	-145,251	-137,297	3,000	,000	-21,746	10,606	2,651	1,326
-10.022	-10,022	-6.083	-148,792	-145,822	-136,913	3,000	,000	-21,746	11,879	2,970	1,485
-8.590	-8,590	-6.083	-149,682	-146,394	-136,530	3,000	,000	-21,746	13,152	3,288	1,644
-7.159	-7,159	-6.083	-150,571	-146,965	-136,146	3,000	,000	-21,746	14,425	3,606	1,803
-5.727	-5,727	-6.083	-151,460	-147,536	-135,762	3,000	,000	-21,746	15,699	3,925	1,962
-4.295	-4,295	-6.083	-152,350	-148,107	-135,378	3,000	,000	-21,746	16,972	4,243	2,121
-2.863	-2,863	-6.083	-153,239	-148,678	-134,994	3,000	,000	-21,746	18,245	4,561	2,281
-1.432	-1,432	-6.083	-154,129	-149,249	-134,610	3,000	,000	-21,746	19,518	4,880	2,440
-.000	,000	-6.083	-155,018	-149,820	-134,227	3,000	-6,610	-70,370	20,792	5,198	2,599
1.432	1,432	-6.083	-154,129	-149,249	-134,610	3,000	,000	21,746	19,518	4,880	2,440
2.863	2,863	-6.083	-153,239	-148,678	-134,994	3,000	,000	21,746	18,245	4,561	2,281
4.295	4.295	-6.083	-152,350	-148,107	-135,378	3,000	,000	21,746	16,972	4.243	2,121

5.727	5.727	-6.083	-151.460	-147.536	-135.762	3.000	.000	21.746	15.699	3.925	1.962
7.159	7.159	-6.083	-150.571	-146.965	-136.146	3.000	.000	21.746	14.425	3.606	1.803
8.590	8.590	-6.083	-149.682	-146.394	-136.530	3.000	.000	21.746	13.152	3.288	1.644
10.022	10.022	-6.083	-148.792	-145.822	-136.913	3.000	.000	21.746	11.879	2.970	1.485
11.454	11.454	-6.083	-147.903	-145.251	-137.297	3.000	.000	21.746	10.606	2.651	1.326
12.886	12.886	-6.083	-147.013	-144.680	-137.681	3.000	.000	21.746	9.332	2.333	1.167
14.317	14.317	-6.083	-146.124	-144.109	-138.065	3.000	.000	21.746	8.059	2.015	1.007

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 5
ALFA= .00 MACHNO= .0000 ALTITUDE*******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	.5000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-143.5828	.0000	.0000	.0000	.0882	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-143.5828	14.3174	.0000	.0000	.0882	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 2) *FILE # 2 = CANARD CONTROL SURFACE GEOMETRY*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 6
ALFA= .00 MACHNO= .0000 ALTITUDE*******

SURFACE # 3 = FUSELAGE

LIFTING SURFACE NO= 3
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
9.545	61.666	53.333	.0000	.0000	548.83	.1660	57.500	57.600	2.329	-158.981	.000

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.6[illegible]	1.000	.000	.000	.000	.000	.000	75.784	2	3	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
-60.491	.000	.458	6297.748	78.531	105.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-4.772	-4.772	.000	-162.668	-149.334	-109.334	.000	.000	-75.784	53.333	13.333	6.667
-4.295	-4.295	.000	-164.760	-151.218	-110.593	.000	.000	-75.784	54.166	13.542	6.771
-3.818	-3.818	.000	-166.852	-153.102	-111.852	.000	.000	-75.784	55.000	13.750	6.875
-3.341	-3.341	.000	-168.944	-154.986	-113.111	.000	.000	-75.784	55.833	13.958	6.979
-2.863	-2.863	.000	-171.036	-156.870	-114.370	.000	.000	-75.784	56.666	14.167	7.083
-2.386	-2.386	.000	-173.128	-158.753	-115.629	.000	.000	-75.784	57.500	14.375	7.187
-1.909	-1.909	.000	-175.221	-160.637	-116.887	.000	.000	-75.784	58.333	14.583	7.292
-1.432	-1.432	.000	-177.313	-162.521	-118.146	.000	.000	-75.784	59.166	14.792	7.396
-.954	-.954	.000	-179.405	-164.405	-119.405	.000	.000	-75.784	60.000	15.000	7.500
-.477	-.477	.000	-181.497	-166.289	-120.664	.000	.000	-75.784	60.833	15.208	7.604
.000	.000	.000	-183.589	-168.173	-121.923	.000	23.020	-57.119	61.666	15.417	7.708
.477	.477	.000	-181.497	-166.289	-120.664	.000	.000	75.784	60.833	15.208	7.604
.954	.954	.000	-179.405	-164.405	-119.405	.000	.000	75.784	60.000	15.000	7.500
1.432	1.432	.000	-177.313	-162.521	-118.146	.000	.000	75.784	59.166	14.792	7.396
1.909	1.909	.000	-175.221	-160.637	-116.887	.000	.000	75.784	58.333	14.583	7.292
2.386	2.386	.000	-173.128	-158.753	-115.629	.000	.000	75.784	57.500	14.375	7.187
2.863	2.863	.000	-171.036	-156.870	-114.370	.000	.000	75.784	56.666	14.167	7.083
3.341	3.341	.000	-168.944	-154.986	-113.111	.000	.000	75.784	55.833	13.958	6.979
3.818	3.818	.000	-166.852	-153.102	-111.852	.000	.000	75.784	55.000	13.750	6.875
4.295	4.295	.000	-164.760	-151.218	-110.593	.000	.000	75.784	54.166	13.542	6.771
4.772	4.772	.000	-162.668	-149.334	-109.334	.000	.000	75.784	53.333	13.333	6.667

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 7
ALFA= .00 MACHNO= .0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-121.9228	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
-109.3344	4.7725	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

(EOF PLOT FILE 3) *FILE # 3 = FUSELAGE GEOMETRY*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 8
ALFA= .00 MACHNO= .0000 ALTITUDE=******

SURFACE # 4 = VERTICAL FINS

LIFTING SURFACE NO= 4
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
14.391	27.344	6.922	-1.0000	-1.0000	246.56	.8399	17.133	19.162	14.317	-15.691	-5.442

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MCC/4	SWEEP MCC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	89,999	57,424	3	2	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
-60,491	,000	,458	6297,748	78,531	105,000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
.000	14,317	.073	-31,552	-24,716	-4,208	-1,000	-,441	85,620	27,344	6,836	3,418
.720	14,317	-,646	-30,171	-23,590	-3,848	-1,000	89,999	57,426	26,323	6,581	3,290
1.439	14,317	-1,366	-28,789	-22,464	-3,487	-1,000	89,999	57,426	25,302	6,325	3,163
2.159	14,317	-2,085	-27,408	-21,338	-3,127	-1,000	89,999	57,426	24,281	6,070	3,035
2.878	14,317	-2,805	-26,026	-20,212	-2,767	-1,000	89,999	57,426	23,260	5,815	2,907
3,598	14,317	-3,524	-24,645	-19,085	-2,406	-1,000	89,999	57,426	22,239	5,560	2,780
4,317	14,317	-4,244	-23,263	-17,959	-2,046	-1,000	89,999	57,426	21,218	5,304	2,652
5.037	14,317	-4,963	-21,882	-16,833	-1,685	-1,000	89,999	57,426	20,197	5,049	2,525
5,756	14,317	-5,683	-20,500	-15,707	-1,325	-1,000	89,999	57,426	19,175	4,794	2,397
6,476	14,317	-6,402	-19,119	-14,580	-,965	-1,000	89,999	57,426	18,154	4,539	2,269
7,195	14,317	-7,122	-17,737	-13,454	-,604	-1,000	89,999	57,426	17,133	4,283	2,142
7,915	14,317	-7,842	-16,356	-12,328	-,244	-1,000	89,999	57,426	16,112	4,028	2,014
8,635	14,317	-8,561	-14,974	-11,202	,117	-1,000	89,999	57,426	15,091	3,773	1,886
9,354	14,317	-9,281	-13,593	-10,075	,477	-1,000	89,999	57,426	14,070	3,518	1,759
10,074	14,317	-10,000	-12,211	-8,949	,837	-1,000	89,999	57,426	13,049	3,262	1,631
10,793	14,317	-10,720	-10,830	-7,823	1,198	-1,000	89,999	57,426	12,028	3,007	1,503
11,513	14,317	-11,439	-9,448	-6,697	1,558	-1,000	89,999	57,426	11,007	2,752	1,376
12,232	14,317	-12,159	-8,067	-5,571	1,919	-1,000	89,999	57,426	9,986	2,496	1,248
12,952	14,317	-12,878	-6,685	-4,444	2,279	-1,000	89,999	57,426	8,965	2,241	1,121
13,671	14,317	-13,598	-5,304	-3,318	2,640	-1,000	89,999	57,426	7,944	1,986	,993
14,391	14,317	-14,317	-3,922	-2,192	3,000	-1,000	89,999	57,426	6,923	1,731	,865

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 9
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= ,00 MACHNO= ,0000 ALTITUDE*******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
,0000	1.0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
-4.2083	14.3174	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
3.0000	14.3174	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

(EOF PLOT FILE 4) *FILE # 4 = LEFT VERTICAL FIN GEOMETRY*

(EOF PLOT FILE 5) *FILE # 5 = RIGHT VERTICAL FIN GEOMETRY (IMAGE)*

NOTATION = 1/(1,1), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT CONSIDERING SURFACE # 1 ALONE.

SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 1/(1, 1)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	,0227	2,386	,000	2,386	,2030	,0019	,1996	,0356	-,0496	,2118	-,0034	,0011	-1,0000
13	,0682	7,159	,368	7,159	,2600	-,0018	,2564	,0448	-,0431	,2413	-,0081	,0315	-,9995
14	,1136	11,931	1,026	11,931	,2622	-,0062	,2593	,0445	-,0515	,2156	-,0089	,0265	-,9996
15	,1591	16,703	1,517	16,704	,3139	-,0071	,3103	,0533	-,0405	,2332	-,0196	,0195	-,9996
16	,2045	21,476	1,846	21,477	,3283	-,0146	,3259	,0545	-,0241	,2188	-,0354	,0175	-,9992
17	,2500	26,248	2,022	26,249	,3339	-,0271	,3335	,0533	-,0180	,1905	-,0398	,0139	-,9991
18	,2955	31,021	2,040	31,022	,3442	-,0341	,3449	,0538	-,0192	,1625	-,0496	,0118	-,9987
19	,3409	35,793	1,770	35,794	,3752	-,0407	,3766	,0581	-,0239	,1398	-,0557	,0009	-,9984
20	,3864	40,566	1,293	40,567	,4301	-,0493	,4321	,0661	-,0281	,1171	-,0562	,0011	-,9984
21	,4318	45,338	,816	45,339	,5193	-,0655	,5228	,0788	-,0349	,0894	-,0594	,0020	-,9982
22	,4773	50,111	,338	50,112	,7439	-,1086	,7515	,1103	-,0721	,0833	-,0666	,0039	-,9978

JOBFLAG 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 EXAMPLE PROBLEM NO, 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 10
VALUE 22 6 2 3 0 6 2 3 2 0 0 0 0 0 0 0 0 1 1 0 ALFA= 10,00 MACHNO= ,2000 ALTITUDE*******

ORIGINAL PAGE IS OF POOR QUALITY

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS,= 1 - 1
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3048	-,0160	-,0000	,3030	,0372	-,0622	-,0000	-,0000	-59,77	,97	6196,66	76,78	104,99
1	,0396*	,0163*	,0000*	,0361*	,0230*	-,0064*	-,0000*	,0000*	-59,77*	,97*	6196,66*	76,78*	104,99*

*** AIRLOAD SUMS ***

AC	,3048	-,0160	-,0000	,3030	,0372	-,0622	-,0000	-,0000	-59,77	,97	6196,66	76,78	104,99
CG	,2999	-,0157	-,0000	,2981	,0366	-,0624	-,0000	-,0000	-60,49	,46	6297,75	78,53	105,00
AC	,0396*	,0163*	,0000*	,0361*	,0230*	-,0064*	-,0000*	,0000*	-59,77*	,97*	6196,66*	76,78*	104,99*
CG	,0389*	,0161*	,0000*	,0356*	,0226*	-,0066*	-,0000*	,0000*	-60,49*	,46*	6297,75*	78,53*	105,00*

* DETERMINANT= -,1875+13 * SCALE= ,1731-01 *

LIFT COEFFICIENT FOR WING ALONE IS C_L *= 0.2981 WITH L.E. SUCTION (BLUNT L.E.)*
= 0.3337 NO L.E. SUCTION (SHARP L.E.)

SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 1/(1, 2)
****

NOTATION = 1/(1,2), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT CONSIDERING SURFACES # 1 AND # 2 SIMULTANEOU

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2.386	.000	2.386	.1354	.0041	.1327	.0242	-.0469	.1408	-.0027	.0009	-1.0000
13	.0682	7.159	.368	7.159	.1769	.0004	.1742	.0308	-.0438	.1640	-.0074	.0313	-.9995
14	.1136	11.931	1.026	11.931	.1944	-.0033	.1920	.0332	-.0495	.1596	-.0091	.0266	-.9996
15	.1591	16.703	1.517	16.704	.2452	-.0049	.2423	.0417	-.0399	.1821	-.0197	.0197	-.9996
16	.2045	21.476	1.846	21.477	.2743	-.0116	.2722	.0456	-.0259	.1827	-.0353	.0174	-.9992
17	.2500	26.248	2.022	26.249	.2932	-.0230	.2928	.0469	-.0196	.1672	-.0397	.0138	-.9991
18	.2955	31.021	2.040	31.022	.3134	-.0304	.3139	.0491	-.0199	.1479	-.0496	.0118	-.9987

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 11
ALFA= 10.00 MACHNO= .2000 ALTITUDE*******

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
19	.3409	35.793	1.770	35.794	.3497	-.0374	.3509	.0542	-.0240	.1302	-.0556	.0009	-.9985
20	.3864	40.566	1.293	40.567	.4081	-.0464	.4100	.0628	-.0278	.1111	-.0561	.0010	-.9984
21	.4318	45.338	.816	45.339	.4997	-.0627	.5030	.0759	-.0345	.0860	-.0593	.0019	-.9982
22	.4773	50.111	.338	50.112	.7241	-.1053	.7313	.1074	-.0711	.0519	-.0664	.0039	-.9978

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/(1, 2)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2.386	-6.196	107.733	.9782	.0897	.9478	.1854	-.1495	.6179	.1061	-.0158	-.9942
28	.2500	7.159	-6.112	112.505	1.1336	.0804	1.1024	.2108	-.1194	.5554	.1311	-.0246	-.9911
29	.4167	11.931	-6.063	117.278	1.1479	.0670	1.1189	.2110	-.1132	.3978	.1249	-.0314	-.9917

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.2479	-.0132	.0000	.2464	.0300	-.0667	-.0000	-.0000	-59.77	.97	6196.66	76.78	104.99
1	.0338*	.0142*	.0000*	.0308*	.0196*	-.0070*	-.0000*	.0000*	-59.77*	.97*	6196.66*	76.78*	104.99*
2	1.0700	.0813	.0000	1.0396	.2658	-.1462	-.0000	.0000	-147.38	-6.26	413.07	15.36	28.63
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	-147.38*	-6.26*	413.07*	15.36*	28.63*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 12
ALFA= 10.00 MACHNO= .2000 ALTITUDE*******

*** AIRLOAD SUMS ***

AC	.3192	-.0078	.0000	.3157	.0478	.0133	-.0000	-.0000	-59.77	.97	6196.66	76.78	104.99
CG	.3141	-.0077	.0000	.3106	.0470	.0099	-.0000	-.0000	-60.49	.46	6297.75	78.53	105.00
AC	.0338*	.0142*	.0000*	.0308*	.0196*	-.0070*	-.0000*	.0000*	-59.77*	.97*	6196.66*	76.78*	104.99*
CG	.0332*	.0137*	.0000*	.0303*	.0193*	-.0072*	-.0000*	.0000*	-60.49*	.46*	6297.75*	78.53*	105.00*

* DETERMINANT= -.1070+22 * SCALE= .1505-01 *

LIFT COEFFICIENT FOR WING +CANARD CONTROL SURFACE IS
C_L = 0.3106 (WITH L.E. SUCTION)

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1, 4)
****

NOTATION = 1/(1,4), INDICATES SOLUTION FOR SURFACE # 1 IS OUTPUT CONSIDERING SURFACES #1, #2, #3, and #4 SIMULTANEOUSLY

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
12	.0227	2.386	.000	2.386	.1155	.0003	.1137	.0201	-.0336	.1207	-.0129	.0043	-.9999
13	.0682	7.159	.368	7.159	.1494	-.0023	.1476	.0256	-.0329	.1389	-.0303	.0388	-.9988
14	.1136	11.931	1.026	11.931	.1832	-.0006	.1805	.0317	-.0271	.1501	-.0833	.0469	-.9954
15	.1591	16.703	1.517	16.704	.2314	-.0024	.2283	.0398	-.0596	.1715	.0191	-.0209	-.9996
16	.2045	21.476	1.846	21.477	.2616	-.0126	.2598	.0432	-.0402	.1744	-.0264	.0150	-.9995
17	.2500	26.249	2.022	26.249	.2986	-.0148	.2966	.0493	-.0296	.1694	-.0426	.0146	-.9990
18	.2955	31.021	2.040	31.022	.3212	-.0306	.3217	.0505	-.0213	.1516	-.0460	.0108	-.9989
19	.3409	35.793	1.770	35.794	.3511	-.0372	.3523	.0545	-.0240	.1307	-.0555	.0009	-.9985
20	.3864	40.566	1.293	40.567	.4076	-.0455	.4093	.0629	-.0280	.1110	-.0555	.0009	-.9985
21	.4318	45.338	.816	45.339	.4988	-.0615	.5019	.0759	-.0346	.0858	-.0593	.0019	-.9982
22	.4773	50.111	.338	50.112	.7226	-.1047	.7298	.1073	-.0710	.0518	-.0663	.0039	-.9978

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	22	6	2	3	0	6	2	3	2	0	0	0	0	0	0	0	0	1	1	0

EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD PAGE 13
ALFA= 10.00 MACHNO= .2000 ALTITUDE*******

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/(1, 4)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
27	.0833	2.386	-6.196	107.733	1.0252	.1017	.9920	.1957	-.1433	.6468	.1166	-.0164	-.9930
28	.2500	7.159	-6.112	112.505	1.2074	.0904	1.1734	.2254	-.1308	.5911	.1312	-.0246	-.9911
29	.4167	11.931	-6.063	117.278	1.2471	.0793	1.2144	.2303	-.1267	.4318	.1267	-.0315	-.9914

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 3/(1, 4)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
32	.2500	2.386	.000	137.607	.0288	.0079	.0270	.0064	-.0150	.1626	.0693	-.2129	-.9746

```
                              SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 4/( 1, 4)
                              ****************************************************

 J    Y*       Y        Z        W       SCN      SCX      SCL      SCD    SMP C/4  SCLC/B     1XL     1YL      1ZL

38  ,9949   14,317   -2,074  151,937*************************** 943,53992580,0793*********   ,0768   ,9943   ,0766
39  ,9949   14,317   -6,943  156,7346153,4659*********6682,7775 445,7413 796,36737956,2665   ,0032  -1,0000   ,0033
40  ,9949   14,317  -11,811  161,531  75,2273 -93,2598  90,2788  -3,1313 -53,5006  64,7788  -,0162   ,9997  -,0165
```

SECTION LIFT COEFFICIENTS FOR SURFACE # 4 ARE OUT OF R
SEE NOTE # 1. †

```
                              INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS,= 1 - 4
                              ****************************************************

 E    ECN     ECX     ECY     ECL     ECD     ECMP    ECMR    ECMY    EXA    EZA    ES    EMGC    EB
```

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 3 - XB-70 AIRPLANE SUBSONIC AEROD  PAGE
 VALUE  22  6  2  3  0  6  2  3  2  0  0  0  0  0  0  0  0  1  1  0         ALFA= 10.00  MACHNO= .2000  ALTITUDE*******      14

                              INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 4
                              ****************************************************

 E       ECN      ECX      ECY      ECL      ECD      ECMP     ECMR     ECMY       EXA      EZA       ES      EMGC      EB

 1     .2368   -.0129    .0000    .2355    .0285   -.0651   -.0000   -.0000    -59.77      .97  6196.66    76.78   104.99
 1     .0314*   .0129*  -.0000*   .0286*   .0182*  -.0070*  -.0000*   .0000*   -59.77*     .97* 6196.66*   76.78*  104.99*
 2    1.1382    .0927    .0000   1.1048    .2889   -.1511   -.0000    .0000   -147.38    -6.26   413.07    15.36    28.63
 2     .0000*   .0000*   .0000*   .0000*   .0000*   .0000*   .0000*   .0000*  -147.38*   -6.26*  413.07*   15.36*   28.63*
 3     .0288    .0079    .0000    .0270    .0128   -.0151    .0000    .0000   -158.98      .00   548.83    57.60     9.54
 3     .0000*   .0000*   .0000*   .0000*   .0000*   .0000*   .0000*   .0000*  -158.98*     .00*  548.83*   57.60*    9.54*
 4     .0710   -.0372    .0000    .0764   -.0243    .0324   -.0000    .0000    -15.69    -5.44   493.13    19.16    14.39
 4 *********    .0372*  -.0000*********595.0331**********    .0000*   .0000*   -15.69*   -5.44*  493.13*   19.16*   14.39*

                                          *** AIRLOAD SUMS ***

AC     .3209   -.0089    .0000    .3176    .0469    .0195   -.0000   -.0000    -59.77      .97  6196.66    76.78   104.99
CG     .3157   -.0088    .0000    .3125    .0462    .0159   -.0000   -.0000    -60.49      .46  6297.75    78.53   105.00
AC 272.7076*    .0159*  -.0000*268.5618* 47.3708**********    .0000*  -.0000*   -59.77*     .97* 6196.66*   76.78*  104.99*
CG 268.3302*    .0156*  -.0000*264.2510* 46.6104**********    .0000*  -.0000*   -60.49*     .46* 6297.75*   78.53*  105.00*

                              * DETERMINANT=  .5384+32 * SCALE=  .1409-01 *
```

VORTEX-LIFT INCREMENTS FOR SURFACE # 4 ARE OUT OF RANGE

SEE NOTE # 2. †

```
**** JOB TIME= 246 / ELAPSED TIME= 246 / NO.PLOT FILES=   5 / NSURF EXEC. VERSION 6-18-72 ****

*******************************************************************************************
*******************************************************************************************
```

XQT TRWPLT PRINTED OUTPUT OMITTED

SEE INPUT DATA LISTINGS

---

† NOTES:

[1] THE SECTION COEFFICIENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE OF THE "F" FORMAT SPECIFICATION USED FOR THE PRINTED OUTPUT. THIS ANOMALY ARISES BECAUSE OF THE MANNER IN WHICH THESE COEFFICIENTS ARE CALCULATED, i.e., THE AIRLOADS OBTAINED IN THE VORTEX-LATTICE SOLUTION ARE NORMALIZED BY (DIVIDED BY) THE PROJECTED AREA OF THE SURFACE ON A HORIZONTAL PLANE WHICH IS OF ZERO ORDER FOR A VERTICAL SURFACE. THIS PROGRAMMING ERROR DOES NOT IN ANY WAY AFFECT THE ACCURACY OF THE VORTEX-LATTICE SOLUTION OR THE SPATIALLY-INTEGRATED AIRLOAD COEFFICIENTS WHICH ARE NORMALIZED BY A DIFFERENT AREA.

[2] THE VORTEX-LIFT INCREMENTS CALCULATED FOR SURFACE # 4, THE VERTICAL FINS, ARE OUT OF RANGE AND IN ERROR FOR THE SAME REASONS OUTLINED IN NOTE # 1.

[3] TO DEMONSTRATE THE VERACITY OF THE SOLUTIONS CALCULATED WITH AND WITHOUT VERTICAL FINS A COMPARISON OF THE NET-AIRLOAD COEFFICIENTS ABOUT THE C.G. OBTAINED FOR THE VORTEX-LATTICE SOLUTIONS (WITH L.E. SUCTION) IS GIVEN BELOW

CODE	DESCRIPTION	C_L	C_{D_i}	$C_{M_{CG}}$
(1,1)	WING ALONE	0.2981	0.0366	-0.0624
(1,2)	WING + CANARD	0.3106	0.0470	+0.0099
(1,4)	WING + CANARD + FUSELAGE + VERT. FINS	0.3125	0.0462	+0.0159

6.5 EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS

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                    SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B

                              TRW SYSTEMS INC., HOUSTON OPERATIONS

                                    HOUSTON, TEXAS (77058)

          **** JOBS INPUT LIST ****

7 XQT NSURF
 EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMIC ANALYSIS
 TASK 702, PROJECT 33034, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO. HA010B (NSURF)
                                       A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=3, NVTAIL=0, NFUS=0, COLOCP=0.75,
 NFLG(1)=3*10, NFLG(6)=3*5, NFLG(19)=1,2,
 NCS=2*10,2, NSS=2,4,6,
 THICKW= 1,
 XOC(1,1)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
 XOC(1,2)= .00, .05, .10, .15, .20, .30, .40, .60, .80, 1.0,
 ZOC(1,1)=.0,.04443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
 ZOC(1,2)=.0,.04443,.05853,.06682,.07172,.07502,.07254,.05704,.03279,.0,
 ZOC(1,3)=.0,-.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
 ZOC(1,4)=.0,-.04443,-.05853,-.06682,-.07172,-.07502,-.07254,-.05704,-.03279,.0,
 X = 0,0,     0,0,
 Y = 0,10,    0,10,
 Z = 0,0,     0,0,
 C = 10,10,   10,10,
 E = 0,0,     0,0,
 Z = 0,0, 0,0,
 FLATP= 1,
 XOC(1,3)= .00, 1.0,
 ZOC(1,5)=.0, .0,
 ZOC(1,6)=.0, .0,
 X(5)= 0,0,
 Y(5)= 0,10,
 Z(5)= 0,0,
 C(5)= 10,10,
 E(5)= 0,0,
 XCG=0.0, REFC=10.0, REFB=20.0, REFS=200.0,
 NJOB=1, ALFA=10, MACHN=0.0, NSOLV=1,2,3,3
 $END
 $ENDJOBS
7 XQT NSURF
```

```
 JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI  PAGE
 VALUE   10 10 10  0  0  5  5  5  0  0  0  0  0  0  0  0  0  1  1  2        ALFA=    .00  MACHNO= .0000  ALTITUDE=******          1

$INPUT
KOUT     =              +6,
KT1      =              +1,
KT2      =              +8,
KT3      =              +3,
LINK     =             +56,
NWING    =              +3,
NVTAIL   =              +0,
NFUS     =              +0,
COLOCP   =     .75000000E+00,
CUTOF1   =     .10000000E-03,
CUTOF2   =     .29000000E-02,
LFLAP    =              +0,
GSCALE   =     .10000000E+01,
NSS      =              +2,              +4,              +6,              +0,
         +0,
NCS      =             +10,             +10,              +2,              +0,
         +0,
X        =     .00000000E+00,     .00000000E+00,     .00000000E+0
 .00000000E+00,    .00000000E+00,    .00000000E
 .00000000E+00,    .00000000E+0                        E+00,
 .00000000E+00,                                  ,    .12500000E+00,
 .0000                                .12500000E+00,
                 E+00,
         -     .00000000E+00,
YCG      =     .00000000E+00,
ZCG      =     .00000000E+00,
REFS     =     .20000000E+03,
REFC     =     .10000000E+02,
REFB     =     .20000000E+02,
NJOB     =              +1,
ALFA     =     .10000000E+02,     .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,
MACHN    =     .00000000E+00,     .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
HEIGHT   =     .10000000E+05,     .10000000E+05,     .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,    .10000000E+05,
 .10000000E+05,    .10000000E+05,    .10000000E+05,
FLAPDJ   =     .00000000E+00,     .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,
TABDJ    =     .00000000E+00,     .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,
AILDJ    =     .00000000E+00,     .00000000E+00,     .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
 .00000000E+00,    .00000000E+00,    .00000000E+00,
NFLG     =             +10,             +10,             +10,             +0,
         +0,              +5,              +5,              +5,
         +0,              +0,              +0,              +0,
         +0,              +0,              +0,              +0,
         +0,              +1,              +1,              +2,
NSOLV    =              +1,              +2,              +3,             +3,
         +0,              +0,              +0,              +0,
         +0,              +0,              +0,              +0,
$END
```

ORIGINAL PAGE IS
OF POOR QUALITY

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 2
ALFA= .00 MACHNO= .0000 ALTITUDE=******

LIFTING SURFACE NO= 1
****

SURFACE # 1 = LOWER SURFACE

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.734

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	200.000	10.000	20.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 3
ALFA= .00 MACHNO= .0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	.0500	.1000	.1500	.2000	.3000	.4000	.6000	.8000	1.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000
.0000	10.0000	.0000	.0444	.0585	.0668	.0717	.0750	.0725	.0570	.0328	.0000

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 6
ALFA= .00 MACHNO= .0000 ALTITUDE=******

LIFTING SURFACE NO= 2
****

SURFACE # 2 = UPPER SURFACE

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	-.734

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	200.000	10.000	20.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 7
ALFA= .00 MACHNO= .0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	.0500	.1000	.1500	.2000	.3000	.4000	.6000	.8000	1.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	-.0444	-.0585	-.0668	-.0717	-.0750	-.0725	-.0570	-.0328	.0000
.0000	10.0000	.0000	-.0444	-.0585	-.0668	-.0717	-.0750	-.0725	-.0570	-.0328	.0000

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 10
ALFA= .00 MACHNO= .0000 ALTITUDE=******

LIFTING SURFACE NO= 3 — *SURFACE # 3 = THIN WING (FLAT PLATE)*
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.000

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	.000	.000	.000	.000	.000	.000	10	5	0

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	200.000	10.000	20.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 11
ALFA= .00 MACHNO= .0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 13
ALFA= .00 MACHNO= .0000 ALTITUDE=******

J	K	XV	YV	ZV	LXV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
25	3	2.000+00	-6.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-5.000+00	0.000	0.000	[illegible]	[illegible]
26	3	2.000+00	-4.000+00	0.000	0.000	1.000+00	0.000	3.000+00	-3.000+00	[illegible]	[illegible]	[illegible]	1.000+00
27	3	2.000+00	-2.000+00	0.000	0.000	1.000+00	0.000	3.000+00	[illegible]	[illegible]	[illegible]	0.000	1.000+00
28	3	2.000+00	0.000	0.000	0.000	1.000+00	[illegible]	[illegible]	[illegible]	0.000	0.000	0.000	1.000+00
29	3	2.000+00	2.000+00	0.000	0.000	[illegible]	[illegible]	[illegible]	-1.000+00	0.000	0.000	0.000	1.000+00
30	3	2.000+00	4.000+00	[illegible]	[illegible]	[illegible]	0.000	7.000+00	1.000+00	0.000	0.000	0.000	1.000+00
31	3	[illegible]	[illegible]	[illegible]	[illegible]	1.000+00	0.000	7.000+00	3.000+00	0.000	0.000	0.000	1.000+00
[illegible]	[illegible]	[illegible]	[illegible]	0.000	0.000	1.000+00	0.000	7.000+00	5.000+00	0.000	0.000	0.000	1.000+00
[illegible]	[illegible]	6.000+00	6.000+00	0.000	0.000	1.000+00	0.000	7.000+00	7.000+00	0.000	0.000	0.000	1.000+00
32	5	6.000+00	8.000+00	0.000	0.000	1.000+00	0.000	7.000+00	9.000+00	0.000	0.000	0.000	1.000+00

(EOF PLOT FILE 3)

LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/(1, 2) — *LOWER SURFACE*
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-2.000	-9.000	.444	4.0000	2.7285	.17193	.00000	1.01942	.03461	-1.11482	.00172	-.2729+01
1	2	-.000	-9.000	.734	4.0000	-.1951	.04557	.00000	.84616	-.13865	-.95122	.12807	.1951+00
1	3	2.000	-9.000	.667	4.0000	-1.1031	.03735	.00000	.81783	-.16698	-.76524	.13630	.1103+01

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 17
ALFA= 10.00 MACHNO= .0000 ALTITUDE=******

LOWER SURFACE

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1, 2)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
6	.0500	1.000	.668	1.000	.9268	.1357	.8892	.1845	-.7111	.4446	.0574	.0000	-.9984
7	.1500	3.000	.668	3.000	.9469	.1384	.9085	.1885	-.6830	.4543	.0616	.0000	-.9981
8	.2500	5.000	.668	5.000	.9756	.1326	.9377	.1924	-.5930	.4689	.0690	.0000	-.9976
9	.3500	7.000	.668	7.000	.9878	.2213	.9344	.2100	-.4762	.4672	.1006	.0000	-.9949
10	.4500	9.000	.668	9.000	.6172	-.0015	.6081	.1059	-.0657	.3041	.1225	.0000	-.9925

UPPER SURFACE

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 2/(1, 2)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
17	.0500	1.000	-.668	21.000	-.1651	.0921	-.1786	-.0127	.6512	-.0893	.0459	-.0000	.9989
18	.1500	3.000	-.668	23.000	-.2141	.1103	-.2300	-.0180	.6162	-.1150	.0479	.0000	.9989
19	.2500	5.000	-.668	25.000	-.3032	.1480	-.3243	-.0270	.5209	-.1622	.0670	.0000	.9978
20	.3500	7.000	-.668	27.000	-.4921	.0445	-.4923	-.0777	.3681	-.2462	.0680	.0000	.9977
21	.4500	9.000	-.668	29.000	-.2507	.2142	-.2841	-.0063	.1903	-.1421	.2801	.0000	.9600

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 2
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.8909	.1253	.0000	.8556	.2781	-.5014	-.0000	.0000	.00	.73	200.00	10.00	20.00
1	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	-.2850	.1218	.0000	-.3019	.0705	.4645	-.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 18
ALFA= 10.00 MACHNO= .0000 ALTITUDE=******

VORTEX-LATTICE SOLUTIONS FOR THICK WING (1,2)

$C_L = 0.5537, \quad C_{D_i} = 0.3485, \quad C_{M_{(C/4)}} = -0.0371$

*** AIRLOAD SUMS ***

AC	.6058	.2471	.0000	.5537	.3485	-.0190	-.0000	.0000	.00	.73	200.00	10.00	20.00
CG	.6058	.2471	.0000	.5537	.3485	-.0371	-.0000	.0000	.00	.00	200.00	10.00	20.00
AC	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
CG	.0003*	.0003*	.0000*	.0002*	.0003*	.0001*	.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

* DETERMINANT= .4360+23 * SCALE= .6619-01 *

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	10	10	10	0	0	5	5	5	0	0	0	0	0	0	0	0	0	1	1	2

EXAMPLE PROBLEM NO. 4 - THICK WING PROBLEM AERODYNAMI PAGE 19
ALFA= 10.00 MACHNO= .0000 ALTITUDE=******

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 3/(3, 3)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
28	.0500	1.000	.000	41.000	.5577	-.0519	.5583	.0878	.0031	.2791	-.0090	.0000	-1.0000
29	.1500	3.000	.000	43.000	.5416	-.0491	.5419	.0855	.0029	.2710	-.0086	.0000	-1.0000
30	.2500	5.000	.000	45.000	.5067	-.0426	.5064	.0806	.0014	.2532	-.0080	.0000	-1.0000
31	.3500	7.000	.000	47.000	.4437	-.0301	.4422	.0718	-.0045	.2211	-.0071	.0000	-1.0000
32	.4500	9.000	.000	49.000	.3261	-.0151	.3238	.0540	-.0191	.1619	-.0152	.0000	-.9999

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 3 - 3
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.00	.73	200.00	10.00	20.00
1	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
2	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.00	-.73	200.00	10.00	20.00
2	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.0000*	.00*	-.73*	200.00*	10.00*	20.00*
3	.4752	-.0378	.0000	.4745	.0453	-.0032	.0000	.0000	.00	.00	200.00	10.00	20.00
3	.0378*	.0378*	.0000*	.0306*	.0438*	.0094*	.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

*** AIRLOAD SUMS ***

AC	.4752	-.0378	.0000	.4745	.0453	-.0060	.0000	.0000	.00	.73	200.00	10.00	20.00
CG	.4752	-.0378	.0000	.4745	.0453	-.0032	.0000	.0000	.00	.00	200.00	10.00	20.00
AC	.0378*	.0378*	.0000*	.0306*	.0438*	.0122*	.0000*	.0000*	.00*	.73*	200.00*	10.00*	20.00*
CG	.0378*	.0378*	.0000*	.0306*	.0438*	.0094*	.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

* DETERMINANT= .3470+12 * SCALE= .9800-01 *

VORTEX-LATTICE SOLUTIONS FOR THIN WING (FLAT PLATE)

$C_L = 0.4745, \quad C_{D_i} = 0.0453, \quad C_{M_{(C/4)}} = -0.0032$

**** JOB TIME= 74 / ELAPSED TIME= 74 / NO.PLOT FILES= 3 / NSURF EXEC. VERSION 6-18-72 ****

****
****

XQT TRWPLT OUTPUT OMITTED

SEE INPUT-DATA LISTINGS

6.6 EXAMPLE PROBLEM # 5, DEBUG-PRINT OUTPUT OPTIONS

```
                    SUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B

                          TRW SYSTEMS INC., HOUSTON OPERATIONS

                                HOUSTON, TEXAS (77058)

        **** JOBS INPUT LIST ****

7 XQT NSURF
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0
 TASK 702, PROJECT 3303A, MJO 147033, AERODYNAMIC ANALYSIS AND DESIGN
 SUBSONIC-FLOW LIFTING SURFACE ANALYSIS, TRW PROGRAM NO, HA010B (NSURF)
                                    A.V.GOMEZ/ 5 JULY 1972
 $INPUT
 NWING=1,
 NSS(1)=2, NCS(1)=2, NFLG(1)=3, NFLG(6)=2, NFLG(11)=1,
 X(1)=2*0., Y(1)=0.,10., Z(1)=2*0., E(1)=2*0., C(1)=2*10., XOCR(1)=2*0.25,
 XOC(1)=0.,1., FLAPDJ(1)= 10., NJOB=1, ALFA= 5, MACHN= 0., NSOLV=1,1,
 NFLG(20)= 0,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1
 $INPUT
 NFLG(20)= 1,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2
 $INPUT
 NFLG(20)= 2,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5
 $INPUT
 NFLG(20)= 5,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8
 $INPUT
 NFLG(20)= 8,
 $END
 EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16
 $INPUT
 NFLG(20)= 16,  NFLG(17)=1,
 $END
 $ENDJOBS
7 XQT NSURF

----------------------------------------------------------------------------------------------------

 JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0   PAGE
  VALUE   3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  0        ALFA=   .00  MACHNO= .0000  ALTITUDE=******      1

 $INPUT
 KOUT     =           +6,
 KT1      =           +1,
 KT2      =           +8,
 KT3      =           +3,
 LINX     =          +56,
 NWING    =           +1,
 NVTAIL   =           +0,
 NFUS     =           +0,
 COLOCP   =    .75000000E+00,
 CUTOF1   =    .10000000E-03,
 CUTOF2   =    .29000000E-02,
 LFLAP    =           +0,
 GSCALE   =    .10000000E+01,
 NSS      =           +2,               +0,               +0,               +0,
         +0,
 NCS      =           +2,               +0,               +0,               +0,
         +0,
 X        =    .00000000E+00,    .00000000E+00,    .0000[illegible]
  .00000000E+00,    .00000000E+00,    .0000[illegible]
  .00000000E+00,    .00000000E+0[illegible]                 .12500000E+00,
  .00000000E+00,    [illegible]         [illegible]0000E+00,
  .0000[illegible]
                   [illegible]0000E+00,
 [illegible]      =    .00000000E+00,
 ZCG      =    .00000000E+00,
 REFS     =    .10000000E+04,
 REFC     =    .10000000E+03,
 REFB     =    .10000000E+03,
 NJOB     =           +1,
 ALFA     =    .50000000E+01,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,
 MACHN    =    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,
 HEIGHT   =    .10000000E+05,    .10000000E+05,    .10000000E+05,
  .10000000E+05,    .10000000E+05,    .10000000E+05,    .10000000E+05,
  .10000000E+05,    .10000000E+05,    .10000000E+05,
 FLAPDJ   =    .10000000E+02,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,
 TABDJ    =    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,
 AILDJ    =    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,    .00000000E+00,
  .00000000E+00,    .00000000E+00,    .00000000E+00,
 NFLG     =           +3,               +0,               +0,               +0,
         +0,          +2,               +0,               +0,
         +0,          +0,               +1,               +0,
         +0,          +0,               +0,               +0,
         +0,          +1,               +0,               +0,
 NSOLV    =           +1,               +1,               +0,               +0,
         +0,          +0,               +0,               +0,
         +0,          +0,               +0,               +0,
 $END
```

ORIGINAL PAGE IS
OF POOR QUALITY

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0   PAGE
VALUE    3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  0        ALFA=   .00  MACHNO= .0000  ALTITUDE=******         2
```

LIFTING SURFACE NO= 1
****

SPAN	ROOT CHORD	TIP CHORD	ROOT TWIST	TIP TWIST	AREA	ASPECT RATIO	MEAN CHORD	MGC (MAC)	YBAR (MGC)	XBAR (MGC)	ZBAR (MGC)
20.000	10.000	10.000	.0000	.0000	200.00	2.0000	10.000	10.000	5.000	.000	.000

FLAP SPAN1	FLAP SPAN2	FLAP SPAN3	FLAP DEFLEC	TAB DEFLEC	L.AIL DEFLEC	R.AIL DEFLEC	DIHED. MGC/4	SWEEP MGC/4	NO.SPAN ELEMENTS	NO.CHORD ELEMENTS	NO.CHORD DISCONT.
.000	.600	1.000	10.000	.000	.000	.000	.000	.000	3	2	1

FUS STA X(CG)	WING STA Y(CG)	WL STA Z(CG)	AREA S(CG)	CHORD C(CG)	SPAN B(CG)
.000	.000	.000	1000.000	100.000	100.000

WS	Y	Z	X(LE)	X(C/4)	X(TE)	TWIST	DIHE(C/4)	SWEP(C/4)	C(WING)	C(FLAP)	C(TAB)
-10.000	-10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-9.000	-9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-8.000	-8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-7.000	-7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-6.000	-6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-5.000	-5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-4.000	-4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-3.000	-3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-2.000	-2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
-1.000	-1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
.000	.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
1.000	1.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
2.000	2.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
3.000	3.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
4.000	4.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
5.000	5.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
6.000	6.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
7.000	7.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
8.000	8.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
9.000	9.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250
10.000	10.000	.000	-2.500	.000	7.500	.000	.000	.000	10.000	2.500	1.250

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0   PAGE
VALUE    3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  0        ALFA=   .00  MACHNO= .0000  ALTITUDE=******         3
```

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/(1, 1)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-.000	.000	.000	.4870	.0062	.4846	.0430	-.1245	.2423	.0163	.0000	-.9999
3	.3333	6.667	.000	6.667	.3010	-.0247	.3020	.0241	.0141	.1510	.0038	-.0163	-.9999

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
1	.0164*	.0164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 0   PAGE
VALUE    3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  0        ALFA=  5.00  MACHNO= .0000  ALTITUDE=******         4
```

*** AIRLOAD SUMS ***

AC	.3630	-.0144	.0000	.3629	.0173	-.0321	-.0000	-.0000	.00	.00	200.00	10.00	20.00
CG	.0726	-.0029	.0000	.0726	.0035	-.0006	-.0000	-.0000	.00	.00	1000.00	100.00	100.00
AC	.3164*	.3164*	.0000*	.0149*	.0178*	.0041*	-.0000*	.0000*	.00*	.00*	200.00*	10.00*	20.00*
CG	.0033*	.0033*	.0000*	.0030*	.0036*	.0001*	-.0000*	.0000*	.00*	.00*	1000.00*	100.00*	100.00*

* DETERMINANT= .1073+02 * SCALE= .7042-01 *

**** JOB TIME= 1 / ELAPSED TIME= 1 / NO.PLOT FILES= 0 / NSURF EXEC. VERSION 6-18-72 ****

****
****

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	1

EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE 7
ALFA= ,00 MACHNO= ,0000 ALTITUDE=******

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
		,0000	1,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
X	**Y**	**ZA(1)/C**	**ZA(2)/C**	**ZA(3)/C**	**ZA(4)/C**	**ZA(5)/C**	**ZA(6)/C**	**ZA(7)/C**	**ZA(8)/C**	**ZA(9)/C**	**ZA(10)/C**
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6,667+00	0,000	6,667+00	6,667+00	6.667+00	7,500+00	5,000+01
2	1	-5,960-08	0,000	0,000	0,000	6.667+00	7,500+00	5,000+01
3	1	6.667+00	0,000	6,667+00	6,667+00	6.667+00	7,500+00	5,000+01
1	2	-6.667+00	0.000	6,667+00	6,667+00	6.667+00	2,500+00	1,667+01
2	2	-5.960-08	0.000	0,000	0,000	6.667+00	2,500+00	1,667+01
3	2	6.667+00	0,000	6,667+00	6,667+00	6.667+00	2,500+00	1,667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6,250-01	-1,000+01	0,000	0,000	1.000+00	0,000	3,125+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	1	-6,250-01	-3,333+00	0,000	0,000	1.000+00	0,000	3,125+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	1	-6,250-01	3,333+00	0,000	0,000	1.000+00	0,000	3,125+00	6,667+00	0,000	0,000	0,000	1,000+00
1	2	5,625+00	-1,000+01	0,000	0,000	1.000+00	0,000	6,875+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	2	5,625+00	-3,333+00	0,000	0,000	1.000+00	0,000	6,875+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	2	5,625+00	3,333+00	0,000	0,000	1.000+00	0,000	6,875+00	6,667+00	0,000	0,000	0,000	1,000+00

SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 1/(1, 1)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-,0000	-,000	,000	,000	,4870	,0062	,4846	,0430	-,1245	,2423	,0103	,0000	-,9999
3	,3333	6,667	,000	6.667	,3010	-,0247	,3020	,0241	,0141	,1510	,0038	-,0163	-,9999

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	1

EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 1 PAGE 8
ALFA= 5,00 MACHNO= ,0000 ALTITUDE=******

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS,= 1 - 1
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200,00	10,00	20,00
1	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*
						*** AIRLOAD SUMS ***							
AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200,00	10,00	20,00
CG	,0726	-,0029	,0000	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	1000,00	100,00	100,00
AC	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*
CG	,0033*	,0033*	,0000*	,0030*	,0036*	,0001*	-,0000*	,0000*	,00*	,00*	1000,00*	100,00*	100,00*

* DETERMINANT= ,1073+02 * SCALE= ,7042-01 *

**** JOB TIME= 1 / ELAPSED TIME= 2 / NO,PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 ****

****
****

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	2

EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2 PAGE 11
ALFA= ,00 MACHNO= ,0000 ALTITUDE=******

		XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
		,0000	1,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
X	**Y**	**ZA(1)/C**	**ZA(2)/C**	**ZA(3)/C**	**ZA(4)/C**	**ZA(5)/C**	**ZA(6)/C**	**ZA(7)/C**	**ZA(8)/C**	**ZA(9)/C**	**ZA(10)/C**
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6,667+00	0,000	6,667+00	6,667+00	6.667+00	7,500+00	5,000+01
2	1	-5,960-08	0,000	0,000	0.000	6.667+00	7,500+00	5,000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7,500+00	5,000+01

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OF POOR QUALITY

1	2	-6.667+00	0.000	6,667+00	6,667+00	6.667+00	2,500+00	1,667+01
2	2	-5.960-08	0.000	0,000	0.000	6.667+00	2,500+00	1,667+01
3	2	6.667+00	0.000	6,667+00	6,667+00	6.667+00	2,500+00	1,667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0,000	0,000	1.000+00	0,000	3,125+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	1	-6.250-01	-3.333+00	0,000	0,000	1.000+00	0,000	3,125+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	1	-6.250-01	3.333+00	0,000	0.000	1.000+00	0.000	3,125+00	6,667+00	0,000	0,000	0,000	1,000+00
1	2	5.625+00	-1.000+01	0,000	0,000	1.000+00	0,000	6,875+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	2	5.625+00	-3.333+00	0,000	0,000	1.000+00	0,000	6,875+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	2	5,625+00	3.333+00	0,000	0,000	1.000+00	0,000	6,875+00	6,667+00	0,000	0,000	0,000	1,000+00

LIFT DISTRIBUTION DETAIL-SURFACE NO,= 1/(1, 1)
****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-,625	-6,667	.000	50,0000	,3925	,08384	,00000	,99673	,00054	,00568	,00332	-,1472+01
1	2	5,620	-6.667	.054	16,6667	,0302	-,00380	-,01627	,99893	,00287	-,00472	,09088	-,3780-01

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 2	PAGE
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	2	ALFA= 5,00 MACHNO= ,0000 ALTITUDE=******	12

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
2	1	-,625	-.000	,000	50,0000	,3178	-,01821	,00000	1,00180	,00541	,00000	,10236	-,1192+01
2	2	5,616	-,000	.109	16,6667	,9942	-,01031	,00000	,99872	,00253	,00000	,09747	-,1243+01
3	1	-,625	6.667	,000	50,0000	,3925	,08384	,00000	,99673	,00054	-,00568	,00332	-,1472+01
3	2	5,620	6.667	,054	16,6667	,0302	-,00380	,01627	,99893	,00287	,00472	,09088	-,3780-01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 1/(1, 1)
****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-.0000	-,000	,000	,000	,4870	,0062	,4846	,0430	-,1245	,2423	,0183	,0000	-,9999
3	,3333	6,667	,000	6,667	.3010	-,0247	,3020	,0241	.0141	,1510	,0038	-,0163	-,9999

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS,= 1 - 1
****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	.00	200,00	10,00	20,00
1	,0164*	,0164*	,0000*	.0149*	,0178*	.0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*

*** AIRLOAD SUMS ***

AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200,00	10,00	20,00
CG	,0726	-,0029	,0000	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	1000,00	100,00	100,00
AC	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*
CG	,0033*	,0033*	,0000*	,0030*	,0036*	,0001*	-,0000*	,0000*	,00*	,00*	1000,00*	100,00*	100,00*

* DETERMINANT= ,1073+02 * SCALE= ,7042-01 *

**** JOB TIME= 1 / ELAPSED TIME= 3 / NO,PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 ****

****
****

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5	PAGE
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	5	ALFA= ,00 MACHNO= ,0000 ALTITUDE=******	15

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
,0000	1,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000
,0000	10,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000	,0000

J	K	Y	Z	WL	EW	DWL	OC	OS
1	1	-6.667+00	0,000	6,667+00	6,667+00	6.667+00	7,500+00	5,000+01
2	1	-5.960-08	0.000	0,000	0.000	6.667+00	7,500+00	5,000+01
3	1	6.667+00	0,000	6,667+00	6,667+00	6.667+00	7,500+00	5,000+01
1	2	-6.667+00	0.000	6,667+00	6,667+00	6.667+00	2,500+00	1,667+01
2	2	-5.960-08	0.000	0,000	0,000	6.667+00	2,500+00	1,667+01
3	2	6.667+00	0.000	6.667+00	6,667+00	6.667+00	2,500+00	1,667+01

F

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0,000	0,000	1.000+00	0,000	3,125+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	1	-6.250-01	-3,333+00	0,000	0,000	1.000+00	0,000	3,125+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	1	-6.250-01	3,333+00	0,000	0,000	1,000+00	0,000	3,125+00	6,667+00	0,000	0,000	0,000	1,000+00
1	2	5.625+00	-1,000+01	0,000	0,000	1.000+00	0,000	6,875+00	-6,667+00	0,000	0,000	0,000	1,000+00
2	2	5.625+00	-3,333+00	0,000	0,000	1,000+00	0,000	6,875+00	-5,960-08	0,000	0,000	0,000	1,000+00
3	2	5.625+00	3,333+00	0,000	0,000	1.000+00	0,000	6,875+00	6.667+00	0,000	0,000	0,000	1,000+00

VORTEX LATTICE MATRIX DETAIL-SURFACE NO,= 1/(1, 1)

****

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-,8716-01	,1113+00	,3125+01	-,5960-07	,0000	-,6250+00	-,3333+01	,0000	-,6250+00	,3333+01	,0000
2	1	1	2	-,8716-01	-,5010-01	,3125+01	-,5960-07	,0000	-,6250+00	,3333+01	,0000	-,6250+00	,1000+02	,0000
2	1	1	3	-,8716-01	,2476-01	,3125+01	-,5960-07	,0000	,5616+01	-,3333+01	,1085+00	,5616+01	,3333+01	,1085+00
2	1	1	4	-,8716-01	-,6688-01	,3125+01	-,5960-07	,0000	,5616+01	,3333+01	,1085+00	,5625+01	,1000+02	,0000
3	1	2	1	-,8716-01	-,2505-01	,3125+01	,6667+01	,0000	-,6250+00	-,3333+01	,0000	-,6250+00	,3333+01	,0000
3	1	2	2	-,8716-01	,1072+00	,3125+01	,6667+01	,0000	-,6250+00	,3333+01	,0000	-,6250+00	,1000+02	,0000

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JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5   PAGE
 VALUE   3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  5        ALFA=  5,00  MACHNO= ,0000  ALTITUDE=******       16
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J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
3	1	2	3	-,8716-01	-,3346-01	,3125+01	,6667+01	,0000	,5616+01	-,3333+01	,1085+00	,5616+01	,3333+01	,1085+00
3	1	2	4	-,8716-01	,2002-01	,3125+01	,6667+01	,0000	,5616+01	,3333+01	,1085+00	,5625+01	,1000+02	,0000
2	2	3	1	-,2588+00	,9435-01	,6847+01	-,5960-07	,3256+00	-,6250+00	-,3333+01	,0000	-,6250+00	,3333+01	,0000
2	2	3	2	-,2588+00	-,5275-01	,6847+01	-,5960-07	,3256+00	-,6250+00	,3333+01	,0000	-,6250+00	,1000+02	,0000
2	2	3	3	-,2588+00	,1814+00	,6847+01	-,5960-07	,3256+00	,5616+01	-,3333+01	,1085+00	,5616+01	,3333+01	,1085+00
2	2	3	4	-,2588+00	-,3772-01	,6847+01	-,5960-07	,3256+00	,5616+01	,3333+01	,1085+00	,5625+01	,1000+02	,0000
3	2	4	1	-,8716-01	-,2831-01	,6875+01	,6667+01	,0000	-,6250+00	-,3333+01	,0000	-,6250+00	,3333+01	,0000
3	2	4	2	-,8716-01	,9421-01	,6875+01	,6667+01	,0000	-,6250+00	,3333+01	,0000	-,6250+00	,1000+02	,0000
3	2	4	3	-,8716-01	-,1977-01	,6875+01	,6667+01	,0000	,5616+01	-,3333+01	,1085+00	,5616+01	,3333+01	,1085+00
3	2	4	4	-,8716-01	,1795+00	,6875+01	,6667+01	,0000	,5616+01	,3333+01	,1085+00	,5625+01	,1000+02	,0000

LIFT DISTRIBUTION DETAIL-SURFACE ND,= 1/(1, 1)

****

J	K	P(X)	P(Y)	P(Z)	AREA	CPN	G(X)	G(Y)	G(Z)	VI(X)	VI(Y)	VI(Z)	GAMA
1	1	-,625	-6,667	,000	50,0000	,3925	,08384	,00000	,99673	,00054	,00568	,00332	-,1472+01
1	2	5,620	-6,667	,054	16,6667	,0302	-,00380	-,01627	,99893	,00287	-,00472	,09088	-,3780-01
2	1	-,625	-,000	,000	50,0000	,3178	-,01521	,00000	1,00160	,00541	,00000	,10236	-,1192+01
2	2	5,616	-,000	,109	16,6667	,9942	-,01031	,00000	,99872	,00253	,00000	,09747	-,1243+01
3	1	-,625	6,667	,000	50,0000	,3925	,08384	,00000	,99673	,00054	-,00568	,00332	-,1472+01
3	2	5,620	6,667	,054	16,6667	,0302	-,00380	,01627	,99893	,00287	,00472	,09088	-,3780-01

SECTION AIRLOAD COEFFICIENTS-SURFACE NO,= 1/(1, 1)

****

J	Y*	Y	Z	W	SCN	SCX	SCL	SCD	SMP C/4	SCLC/B	1XL	1YL	1ZL
2	-,0000	-,000	,000	,000	,4870	,0062	,4846	,0430	-,1245	,2423	,0163	,0000	-,9999
3	,3333	6,667	,000	6,667	,3010	-,0247	,3020	,0241	,0141	,1510	,0038	-,0163	-,9999

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 5   PAGE
 VALUE   3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  1  0  5        ALFA=  5,00  MACHNO= ,0000  ALTITUDE=******       17
```

INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS,= 1 - 1

****

E	ECN	ECX	ECY	ECL	ECD	ECMP	ECMR	ECMY	EXA	EZA	ES	EMGC	EB
1	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200,00	10,00	20,00
1	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*

*** AIRLOAD SUMS ***

AC	,3630	-,0144	,0000	,3629	,0173	-,0321	-,0000	-,0000	,00	,00	200,00	10,00	20,00
CG	,0726	-,0029	,0000	,0726	,0035	-,0006	-,0000	-,0000	,00	,00	1000,00	100,00	100,00
AC	,0164*	,0164*	,0000*	,0149*	,0178*	,0041*	-,0000*	,0000*	,00*	,00*	200,00*	10,00*	20,00*
CG	,0033*	,0033*	,0000*	,0030*	,0036*	,0001*	-,0000*	,0000*	,00*	,00*	1000,00*	100,00*	100,00*

* DETERMINANT= ,1073+02 * SCALE= ,7042-01 *

**** JOB TIME= 1 / ELAPSED TIME= 4 / NO,PLOT FILES= 0 / NSURF EXEC, VERSION 6-18-72 ****

JOBFLAG	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VALUE	3	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	1	0	8

EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8 PAGE 20
ALFA= .00 MACHNO= .0000 ALTITUDE=******

XA(1)/C	XA(2)/C	XA(3)/C	XA(4)/C	XA(5)/C	XA(6)/C	XA(7)/C	XA(8)/C	XA(9)/C	XA(10)/C
.0000	1.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

X	Y	ZA(1)/C	ZA(2)/C	ZA(3)/C	ZA(4)/C	ZA(5)/C	ZA(6)/C	ZA(7)/C	ZA(8)/C	ZA(9)/C	ZA(10)/C
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
.0000	10.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

J	K	Y	Z	WL	EW	DWL	DC	DS
1	1	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
2	1	-5.960-08	0.000	0.000	0.000	6.667+00	7.500+00	5.000+01
3	1	6.667+00	0.000	6.667+00	6.667+00	6.667+00	7.500+00	5.000+01
1	2	-6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01
2	2	-5.960-08	0.000	0.000	0.000	6.667+00	2.500+00	1.667+01
3	2	6.667+00	0.000	6.667+00	6.667+00	6.667+00	2.500+00	1.667+01

J	K	XV	YV	ZV	1XV	1YV	1ZV	XN	YN	ZN	1XN	1YN	1ZN
1	1	-6.250-01	-1.000+01	0.000	0.000	1.000+00	0.000	3.125+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	1	-6.250-01	-3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	1	-6.250-01	3.333+00	0.000	0.000	1.000+00	0.000	3.125+00	6.667+00	0.000	0.000	0.000	1.000+00
1	2	5.625+00	-1.000+01	0.000	0.000	1.000+00	0.000	6.875+00	-6.667+00	0.000	0.000	0.000	1.000+00
2	2	5.625+00	-3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	-5.960-08	0.000	0.000	0.000	1.000+00
3	2	5.625+00	3.333+00	0.000	0.000	1.000+00	0.000	6.875+00	6.667+00	0.000	0.000	0.000	1.000+00

```
$DBUGV1
P        =     .31250000E+01,   -.59604645E-07,    .00000000E+00,
B        =    -.62500000E+00,   -.33333333E+01,    .00000000E+00,
D        =    -.62500000E+00,    .33333332E+01,    .00000000E+00,
TANA     =    -.43660927E-01,
GAMA     =     .79577538E-01,
PSIF     =     .34891974E+01,
VCOS     =     .15201368E+00,   -.17101539E+00,    .34816869E+01,
$END
$DBUGV2
PSIF     =    -.34891974E+01,
VCOS     =     .30402735E+00,    .00000000E+00,    .69633738E+01,
$END
```

```
$DBUGV3
PSIF     =     .23621825E+01,
VCOS     =     .30402735E+00,    .00000000E+00,    .93255563E+01,
$END
```

VORTEX LATTICE MATRIX DETAIL-SURFACE NO.= 1/(1, 1)
****

J	K	NP	NG	VFS(MAT)	VIN(MAT)	P(X)	P(Y)	P(Z)	B(X)	B(Y)	B(Z)	D(X)	D(Y)	D(Z)
2	1	1	1	-.8716-01	.1113+00	.3125+01	-.5960-07	.0000	-.6250+00	-.3333+01	.0000	-.6250+00	.3333+01	.0000

```
$DBUGV1
P        =     .31250000E+01,   -.59604645E-07,    .00000000E+00,
B        =    -.62500000E+00,    .33333332E+01,    .00000000E+00,
D        =    -.62500000E+00,    .99999996E+01,    .00000000E+00,
TANA     =    -.43660927E-01,
GAMA     =     .79577538E-01,
PSIF     =     .34891975E+01,
VCOS     =    -.15201368E+00,   -.17101540E+00,   -.34816870E+01,
$END
$DBUGV2
PSIF     =    -.90040575E+00,
VCOS     =    -.11274380E+00,   -.15628919E+00,   -.25822586E+01,
$END
$DBUGV3
PSIF     =     .48349399E+00,
VCOS     =    -.11274380E+00,   -.15628919E+00,   -.20987647E+01,
$END
```

```
$DBUGV1
P        =     .31250000E+01,   -.59604645E-07,    .00000000E+00,
B        =    -.62500000E+00,   -.10000000E+02,    .00000000E+00,
D        =    -.62500000E+00,   -.33333333E+01,    .00000000E+00,
TANA     =    -.43660927E-01,
GAMA     =     .79577538E-01,
PSIF     =     .90040574E+00,
VCOS     =     .39269878E-01,   -.14726204E-01,    .89942843E+00,
$END
$DBUGV2
PSIF     =    -.34891976E+01,
VCOS     =    -.11274381E+00,    .15628920E+00,   -.25822587E+01,
$END
$DBUGV3
PSIF     =     .48349399E+00,
VCOS     =    -.11274381E+00,    .15628920E+00,   -.20987647E+01,
$END
```

```
 PSIF    =   .46490990E-02,
 VCOS    =  -.70147156E-02,   -.49002358E-02,   -.26632830E+00,
 $END


 $DBUGV1
 P       =   .56202524E+01,    .66666664E+01,    .54265035E-01,
 B       =   .56155049E+01,   -.33333333E+01,    .10853007E+00,
 D       =   .56155049E+01,    .33333332E+01,    .10853007E+00,
 TANA    =  -.43660927E-01,
 GAMA    =   .79577538E-01,
 PSIF    =   .66713168E+00,
 VCOS    =   .29099439E-01,    .36028789E-02,    .66648699E+00,
 $END
 $DBUGV2
 PSIF    =  -.20040093E+01,
 VCOS    =  -.58302713E-01,   -.28861600E-01,   -.13353522E+01,
 $END
 $DBUGV3
 PSIF    =   .14523004E-01,
 VCOS    =  -.43835899E-01,   -.28861600E-01,   -.13340865E+01,
 $END


 $DBUGV1
 P       =   .56202524E+01,    .66666664E+01,    .54265035E-01,
 B       =   .56155049E+01,    .33333332E+01,    .10853007E+00,
 D       =   .56250000E+01,    .99999996E+01,    .00000000E+00,
 TANA    =  -.43660927E-01,
 GAMA    =   .79577538E-01,
 PSIF    =   .20042719E+01,
 VCOS    =   .87413603E-01,    .32468731E-01,    .20021014E+01,
 $END
 $DBUGV2
 PSIF    =  -.20042719E+01,
 VCOS    =   .17482721E+00,    .64937462E-01,    .40042028E+01,
 $END
 $DBUGV3
 PSIF    =   .00000000E+00,
 VCOS    =   .17482721E+00,    .64937462E-01,    .40042028E+01,
 $END
                         LIFT DISTRIBUTION DETAIL-SURFACE NO.= 1/( 1, 1)
                         **********************************************

  J  K    P(X)     P(Y)     P(Z)    AREA      CPN     G(X)     G(Y)      G(Z)     VI(X)    VI(Y)    VI(Z)   GAMA

  1  1   -.625   -6.667     .000  50.0000   .3925   .08384   .00000    .99673   .00054   .00568   .00332 -.1472+01
  1  2   5.620   -6.667     .054  16.6667   .0302  -.00380  -.01627    .99893   .00287  -.00472   .09088 -.3780-01
------------------------------------------------------------------------------------------------------------------

JOBFLAG  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8   PAGE
 VALUE   3 0 0 0 0 2 0 0 0  0  1  0  0  0  0  0  0  1  0  8         ALFA= 5.00  MACHNO= .0000  ALTITUDE*******        21

  J  K    P(X)     P(Y)     P(Z)    AREA      CPN     G(X)     G(Y)      G(Z)     VI(X)    VI(Y)    VI(Z)   GAMA

  2  1   -.625    -.000     .000  50.0000   .3178  -.01521   .00000   1.00160   .00541   .00000   .10236 -.1192+01
  2  2   5.616    -.000     .109  16.6667   .9942  -.01031   .00000    .99872   .00253   .00000   .09747 -.1243+01

  3  1   -.625    6.667     .000  50.0000   .3925   .08384   .00000    .99673   .00054  -.00568   .00332 -.1472+01
  3  2   5.620    6.667     .054  16.6667   .0302  -.00380   .01627    .99893   .00287   .00472   .09088 -.3780-01

                       SECTION AIRLOAD COEFFICIENTS-SURFACE NO.= 1/( 1, 1)
                       ***************************************************

  J    Y*       Y       Z       W      SCN     SCX     SCL     SCD   SMP C/4  SCLC/B    1XL     1YL     1ZL

  2  -.0000  -.000    .000    .000   .4870   .0062   .4846   .0430  -.1245   .2423   .0103   .0000  -.9999
  3   .3333  6.667    .000   6.667   .3010  -.0247   .3020   .0241   .0141   .1510   .0038  -.0163  -.9999


                       INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1
                       ***************************************************

 E     ECN     ECX     ECY     ECL     ECD     ECMP     ECMR     ECMY     EXA   EZA     ES      EMGC    EB

 1   .3630  -.0144   .0000   .3629   .0173  -.0321   -.0000   -.0000    .00   .00   200.00   10.00   20.00
 1   .0164*  .0164*  .0000*  .0149*  .0178*  .0041*  -.0000*   .0000*   .00*  .00*  200.00*  10.00*  20.00*
                                     *** AIRLOAD SUMS ***
 AC  .3630  -.0144   .0000   .3629   .0173  -.0321   -.0000   -.0000    .00   .00   200.00   10.00   20.00
 CG  .0726  -.0029   .0000   .0726   .0035  -.0006   -.0000   -.0000    .00   .00  1000.00  100.00  100.00
 AC  .0164*  .0164*  .0000*  .0149*  .0178*  .0041*  -.0000*   .0000*   .00*  .00*  200.00*  10.00*  20.00*
 CG  .0033*  .0033*  .0000*  .0030*  .0036*  .0001*  -.0000*   .0000*   .00*  .00* 1000.00* 100.00* 100.00*
                          * DETERMINANT=  .1073+02 * SCALE=  .7042-01 *
------------------------------------------------------------------------------------------------------------------

JOBFLAG  1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20   EXAMPLE NO.5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 8   PAGE
 VALUE   3 0 0 0 0 2 0 0 0  0  1  0  0  0  0  0  0  1  0  8         ALFA= 5.00  MACHNO= .0000  ALTITUDE*******        22


        **** JOB TIME=  3 / ELAPSED TIME=  7 / NO.PLOT FILES=  0 / NSURF EXEC, VERSION 6-18-72 ****
        ****************************************************************************************
        ****************************************************************************************
```

ORIGINAL PAGE IS OF POOR QUALITY

```
JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16   PAGE
VALUE    3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  1  1  0 16         ALFA=   ,00  MACHNO= ,0000  ALTITUDE=******            25

                      XA(1)/C   XA(2)/C   XA(3)/C   XA(4)/C   XA(5)/C   XA(6)/C   XA(7)/C   XA(8)/C   XA(9)/C  XA(10)/C

                       ,0000    1,0000     ,0000     ,0000     ,0000     .0000     ,0000     ,0000     ,0000     ,0000

    X         Y       ZA(1)/C   ZA(2)/C   ZA(3)/C   ZA(4)/C   ZA(5)/C   ZA(6)/C   ZA(7)/C   ZA(8)/C   ZA(9)/C  ZA(10)/C

 ,0000     ,0000       ,0000     ,0000     ,0000     ,0000     ,0000     .0000     ,0000     ,0000     ,0000     ,0000
 .0000   10,0000       ,0000     .0000     ,0000     ,0000     ,0000     .0000     ,0000     ,0000     ,0000     ,0000


 J  K      Y          Z           WL        EW        DWL        DC         DS

 1  1 -6,667+00   0,000       6,667+00  6,667+00  6,667+00  7,500+00  5,000+01
 2  1 -5,960-08   0,000       0,000     0,000     6,667+00  7,500+00  5,000+01
 3  1  6,667+00   0,000       6,667+00  6,667+00  6,667+00  7,500+00  5,000+01

 1  2 -6,667+00   0,000       6,667+00  6,667+00  6,667+00  2,500+00  1,667+01
 2  2 -5,960-08   0,000       0,000     0,000     6,667+00  2,500+00  1,667+01
 3  2  6,667+00   0,000       6,667+00  6,667+00  6,667+00  2,500+00  1,667+01


 J  K     XV         YV         ZV         1XV        1YV       1ZV        XN         YN        ZN         1XN        1YN        1ZN

 1  1 -6,250-01 -1,000+01   0,000      0,000      1,000+00  0,000     3,125+00 -6,667+00  0,000      0,000      0,000      1,000+00
 2  1 -6,250-01 -3,333+00   0,000      0,000      1,000+00  0,000     3,125+00 -5,960-08  0,000      0,000      0,000      1,000+00
 3  1 -6,250-01  3,333+00   0,000      0,000      1,000+00  0,000     3,125+00  6,667+00  0,000      0,000      0,000      1,000+00

 1  2  5,625+00 -1,000+01   0,000      0,000      1,000+00  0,000     6,875+00 -6,667+00  0,000      0,000      0,000      1,000+00
 2  2  5,625+00 -3,333+00   0,000      0,000      1,000+00  0,000     6,875+00 -5,960-08  0,000      0,000      0,000      1,000+00
 3  2  5,625+00  3,333+00   0,000      0,000      1,000+00  0,000     6,875+00  6,667+00  0,000      0,000      0,000      1,000+00


$DBUGV1
P          =      ,31250000E+01,    -,59604645E-07,     ,00000000E+00,
B          =     -,62500000E+00,    -,33333333E+01,     ,00000000E+00,
D          =     -,62500000E+00,     ,33333332E+01,     ,00000000E+00,
TANA       =     -,43660927E-01,
GAMA       =      ,79577538E-01,
PSIF       =      ,34891974E+01,
VCOS       =      ,15201368E+00,    -,17101539E+00,     ,34816869E+01,
$END
$DBUGV2
PSIF       =     -,34891974E+01,
VCOS       =      ,30402735E+00,     ,00000000E+00,     ,69633738E+01,
$END
-----------------------------------------------------------------------------------------------------------------------------

$DBUGV3
PSIF       =      ,23621825E+01,
VCOS       =      ,30402735E+00,     ,00000000E+00,     ,93255563E+01,
$END
$REFLEX
PX         =      ,00000000E+00,
PY         =     -,62500000E+00,
X1         =      ,10038198E+05,
Y1         =      ,00000000E+00,
PHI        =     -,87266430E-01,
ALFAR      =      ,87266430E-01,                                          ABOUT 50 PAGES OF OUTPUT OMITTED
RX         =     -,10000052E+05,
RY         =      ,87429012E+03,
ZL         =      ,10000000E+05,
COSR       =      ,99619471E+00,
$END
$REFLEX                                                                            --/B       1XL       1YL       1ZL
PX         =      ,19923998E+05,
PY         =      ,17425248E+04,                                        -,1245     ,2423     ,0103     ,0000    -,9999
X1         =      ,10038198E+05,                                ,0241    ,0141     ,1510     ,0038    -,0163    -,9999
Y1         =      ,00000000E+00,
PHI        =     -,87266430E-01,
ALFAR      =      ,87266430E-01,
RX         =      ,10000052E+05,
RY         =      ,87429012E+03
ZL         =      ,1000
COSR       =                      INTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.= 1 - 1
$END                              ****************************************************
        ECN      ECX      ECY      ECL      ECD      ECMP     ECMR     ECMY      EXA     EZA      ES      EMGC      EB

 1     ,3630   -,0144    ,0000    ,3629    ,0173   -,0321   -,0000   -,0000      ,00     ,00   200,00    10,00    20,00
 1     ,0164*   ,0164*   ,0000*   ,0149*   ,0178*   ,0041*  -,0000*   ,0000*     ,00*    ,00*  200,00*   10,00*   20,00*

                                         *** AIRLOAD SUMS ***

AC     ,3630   -,0144    ,0000    ,3629    ,0173   -,0321   -,0000   -,0000      ,00     ,00   200,00    10,00    20,00
CG     ,0726   -,0029    ,0000    ,0726    ,0035   -,0006   -,0000   -,0000      ,00     ,00  1000,00   100,00   100,00
AC     ,0164*   ,0164*   ,0000*   ,0149*   ,0178*   ,0041*  -,0000*   ,0000*     ,00*    ,00*  200,00*   10,00*   20,00*
CG     ,0033*   ,0033*   ,0000*   ,0030*   ,0036*   ,0001*  -,0000*   ,0000*     ,00*    ,00* 1000,00*  100,00*  100,00*

                              * DETERMINANT=  ,1073+02 * SCALE=  ,7042-01 *
-----------------------------------------------------------------------------------------------------------------------------

JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20    EXAMPLE NO,5 - DEBUG-DUMP DEMONSTRATION/ NFLG(20)= 16   PAGE
VALUE    3  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  1  1  0 16         ALFA=  5,00  MACHNO= ,0000  ALTITUDE=******            27


**** JOB TIME=   6 / ELAPSED TIME=  13 / NO,PLOT FILES=   0 / NSURF EXEC, VERSION 6-18-72 ****

*************************************************************************************************
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```

XQT NSURFT

24 AUG 72 10'20' 3.974

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02	
7.865000+00	-6.390000+00	-3.380000+00	5.670000+00	7.103000+00	
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00	*TEST MATRIX* = [M]
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.780000-01	
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01	

3.220950-01	2.931715-01	9.424216-03	-8.727428-02	-1.363442-01	
1.081531-01	1.619780-03	3.541707-02	1.522940-03	-2.353400-02	
-8.700874-02	-1.258476-01	-6.201933-02	1.070551-01	9.249558-02	*INVERSE MATRIX* = $[M]^{-1}$
-2.496730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02	
-2.808256-01	-2.303324-01	-3.456437-02	8.417013-02	1.896721-01	

1.000000+00	-3.469447-18	4.336809-19	-1.782157-18	3.469447-18	
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19	
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18	*UNIT MATRIX* = $[M] \times [M]^{-1}$
4.336809-19	9.757820-19	0.000000	1.000000+00	1.301043-18	
3.469447-18	6.938894-18	8.673617-19	-1.565317-18	1.000000+00	

5.870328+04 — *DETERMINANT*

XQT ISURFT

24 AUG 72 10'20' 6.109

1.032000+00	7.680000+00	3.030000+00	-2.930000+00	-9.780000-02	
7.865000+00	-6.390000+00	-3.380000+00	5.670000+00	7.103000+00	
3.216000+00	8.900000+00	-1.167000+01	8.323000+00	9.992000+00	*TEST MATRIX* = [M]
3.031000+00	-1.030000+00	4.180000+00	9.073000+00	9.780000-01	
1.032000+01	5.690000+00	-3.600000+00	3.780000-02	1.514000+01	

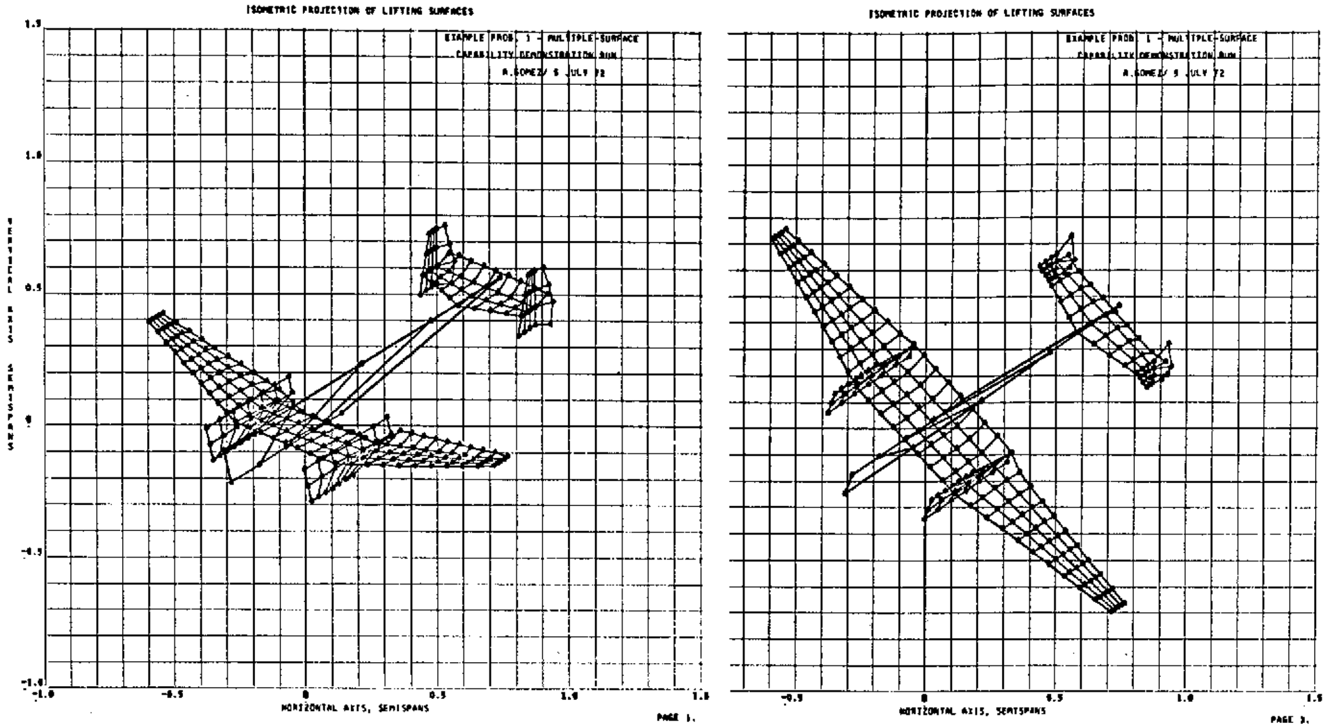
3.220950-01	2.931715-01	9.424216-03	-8.727428-02	-1.363442-01	
1.081531-01	1.619780-03	3.541707-02	1.522940-03	-2.353400-02	
-8.700874-02	-1.258476-01	-6.201933-02	1.070551-01	9.249558-02	*INVERSE MATRIX* = $[M]^{-1}$
-2.496730-02	-1.494837-02	3.317090-02	8.115159-02	-2.028226-02	
-2.808256-01	-2.303324-01	-3.456437-02	8.417013-02	1.896721-01	

1.000000+00	-3.469447-18	4.336809-19	-1.782157-18	3.469447-18	
-8.673617-19	1.000000+00	1.734723-18	-1.029992-18	-8.673617-19	
0.000000	8.673617-19	1.000000+00	-2.463172-18	-1.734723-18	*UNIT MATRIX* = $[M] \times [M]^{-1}$
4.336809-19	9.757820-19	0.000000	1.000000+00	1.301043-18	
3.469447-18	6.938894-18	8.673617-19	-1.565317-18	1.000000+00	

5.870328+04 — *DETERMINANT*

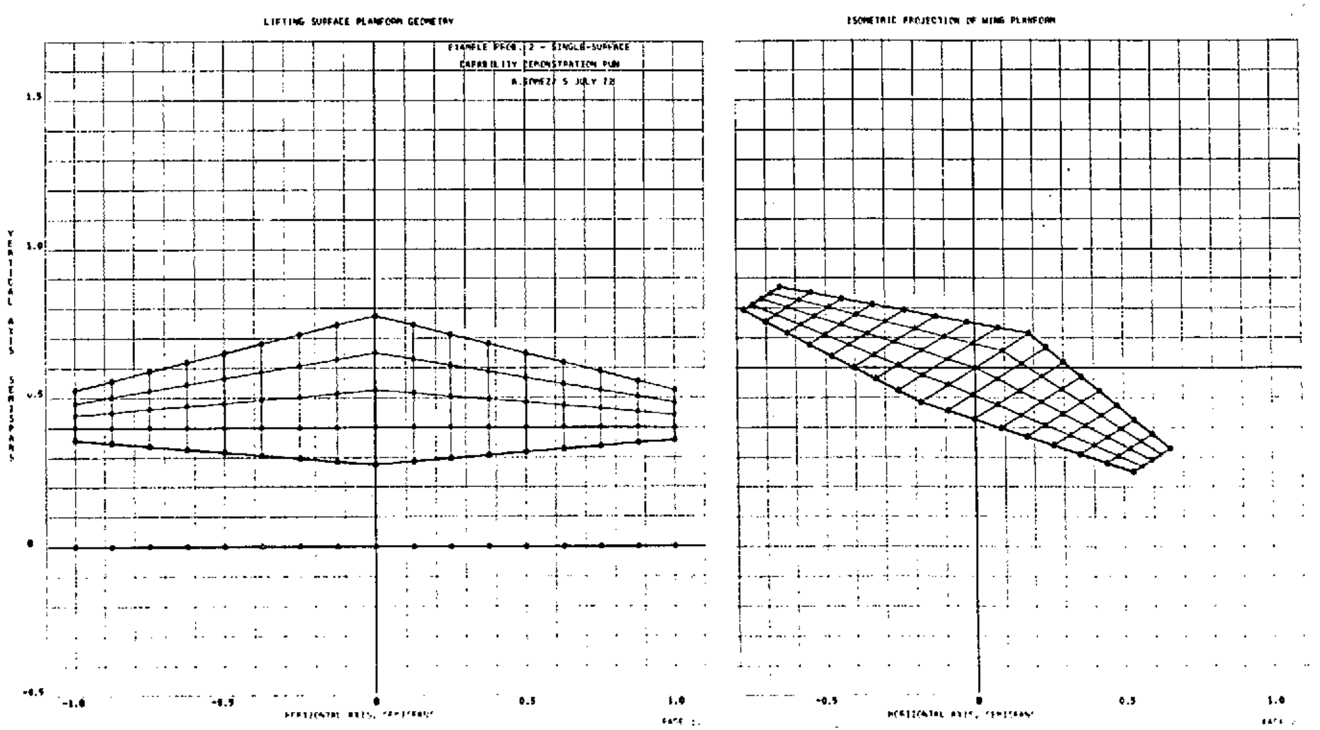
6.7 PLOT-OUTPUT

1) EXAMPLE PROBLEM # 1, MULTIPLE-SURFACE ANALYSIS CAPABILITY



2) EXAMPLE PROBLEM # 2, SINGLE-SURFACE ANALYSIS CAPABILITY

NOTE: THE FIRST TWO PLOTS ARE SHOWN BELOW. THE REMAINDER OF THE PLOT-OUTPUT FOR THIS PROBLEM IS PRESENTED IN FIGURE 2.18[C] (PAGES 2-49 THRU. 2-52)



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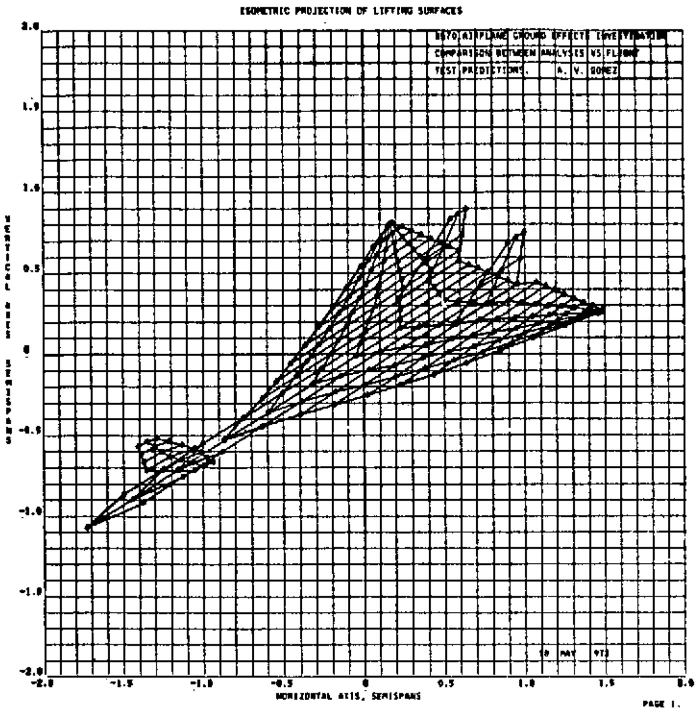
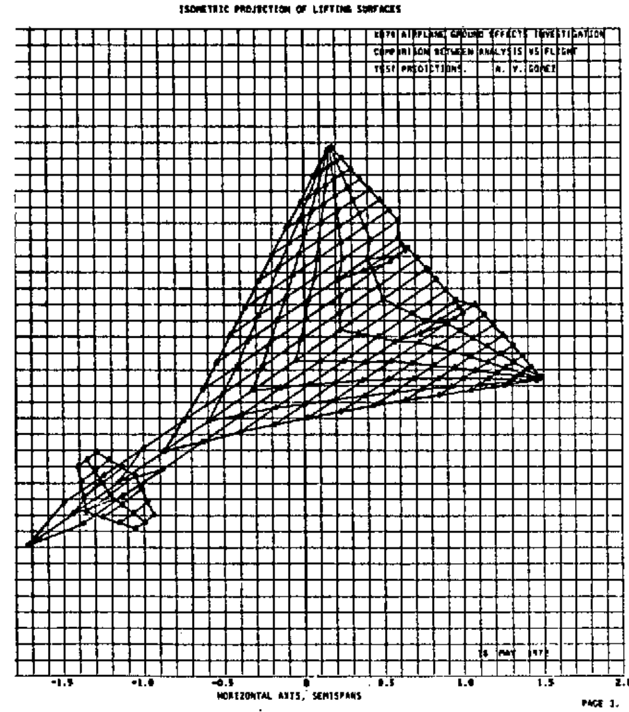
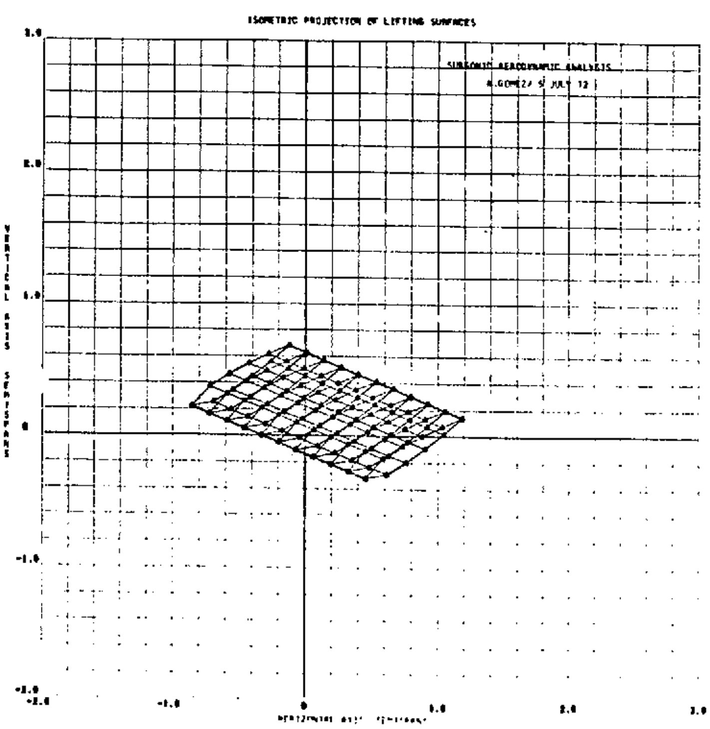
6.7 PLOT-OUTPUT (CONTINUED)

3) EXAMPLE PROBLEM # 3, NORTH AMERICAN XB-70 AIRPLANE





4) EXAMPLE PROBLEM # 4, THICK-WING ANALYSIS



7.0 PROGRAM DESCRIPTION

7.1 Operating Procedures

The "TRW Vortex-Analysis Program #HA010B (N. SURFACE)" is written in Fortran V source language for execution in the UNIVAC 1108 computer, with a 65K core or a computer of similar configuration. Five separate execution modes for the program are permitted:

1) XQT ISURF or XQT NSURF

Two main execution modes for solving lifting-surface problems by the vortex-lattice method are permitted. NAMELIST statements are used exclusively for input of numeric quantities along with "A" formatted read statements for titles and comments. Card input and tabular printed output are on units 5 and 6 respectively. In addition to the program PCF tape, which is assigned to an unused unit, the following units* are also used:

Unit 1 (KT1)	Input data is stored in unit 1 for all the cases that are to be executed.
Unit 8 (KT2)	Output plot-data tape or drum physical unit assignment that is required as an input for the auxiliary execution mode.
Unit 3 (KT3)	Work tape or drum physical unit assignment.

2) XQT ISURFT or NSURFT

Two test execution-modes for determining the accuracy of the matrix inversion procedure are permitted. The test execution-modes require no input data. Tabular printed output is on unit 6.

3) XQT TRWPLT

One auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output is permitted. This mode of execution requires two modes of input, a tape or drum file (Unit KT2) containing the plot data accompanied by punched-card input describing the manner in which the data is to be plotted. A generalized input processor is used which compares the input symbols to an internal symbol table and stores the data in the appropriate address. The card format, which is input in unit 5, consists of BCD symbol equivalences to the input data in a free-form mode. Printed output is in unit 6 and plot output on magnetic tape (PLT tape assignment).

*Units, 1, 3, and 3 (KT1, KT2, and KT3) may be reassigned in execution (see input instructions).

VØRTEX-LATTICE ANALYSIS PRØGRAM (HA010B)

- 7 XQT NSURF
  EXECUTIØN MØDE
  - A01 NSURF(MAIN)
  - A02 BLKDAT
  - A03 LØFT
  - A04 LIFTX
  - A05 ABØRTJ
  - A06 CØRDF
  - A07 CAMBER
  - A08 FLAPS
  - A09 FLAPI
  - A10 REFLEC
  - A11 ISØMET
  - A12 RØTATE
  - A13 VØRTEX
  - A14 DMATIN
  - A15 DØTP
  - A16 CRØSP
  - A17 PAGE
- 7 XQT NSURFT
  EXECUTIØN MØDE
  - A18 NSURFT(MAIN)
  - A14 DMATIN
  - A17 PAGE
- 7 XQT ISURF
  EXECUTIØN MØDE
  - B01 ISURF(MAIN)
  - B02 BLKDAT
  - B03 LØFT
  - B04 DLIFT
  - B05 INTERP
  - B06 DLINER
  - B07 SPANI
  - B08 CHØRDI
  - B09 CHØRDT
  - B10 FLAPS
  - B11 VØRTEX
  - B12 REFLEC
  - B13 DMATIN
  - B14 DØTP
  - B15 CRØSP
  - B16 RØTATE
  - B17 CURFIT
  - B18 CURVE
  - B19 PAGE
- 7 XQT ISURFT
  EXECUTIØN MØDE
  - B20 ISURFT(MAIN)
  - B13 DMATIN
  - B19 PAGE

FIGURE 7.01 - TRW VORTEX-LATTICE ANALYSIS PROGRAM OVERLAY STRUCTURE

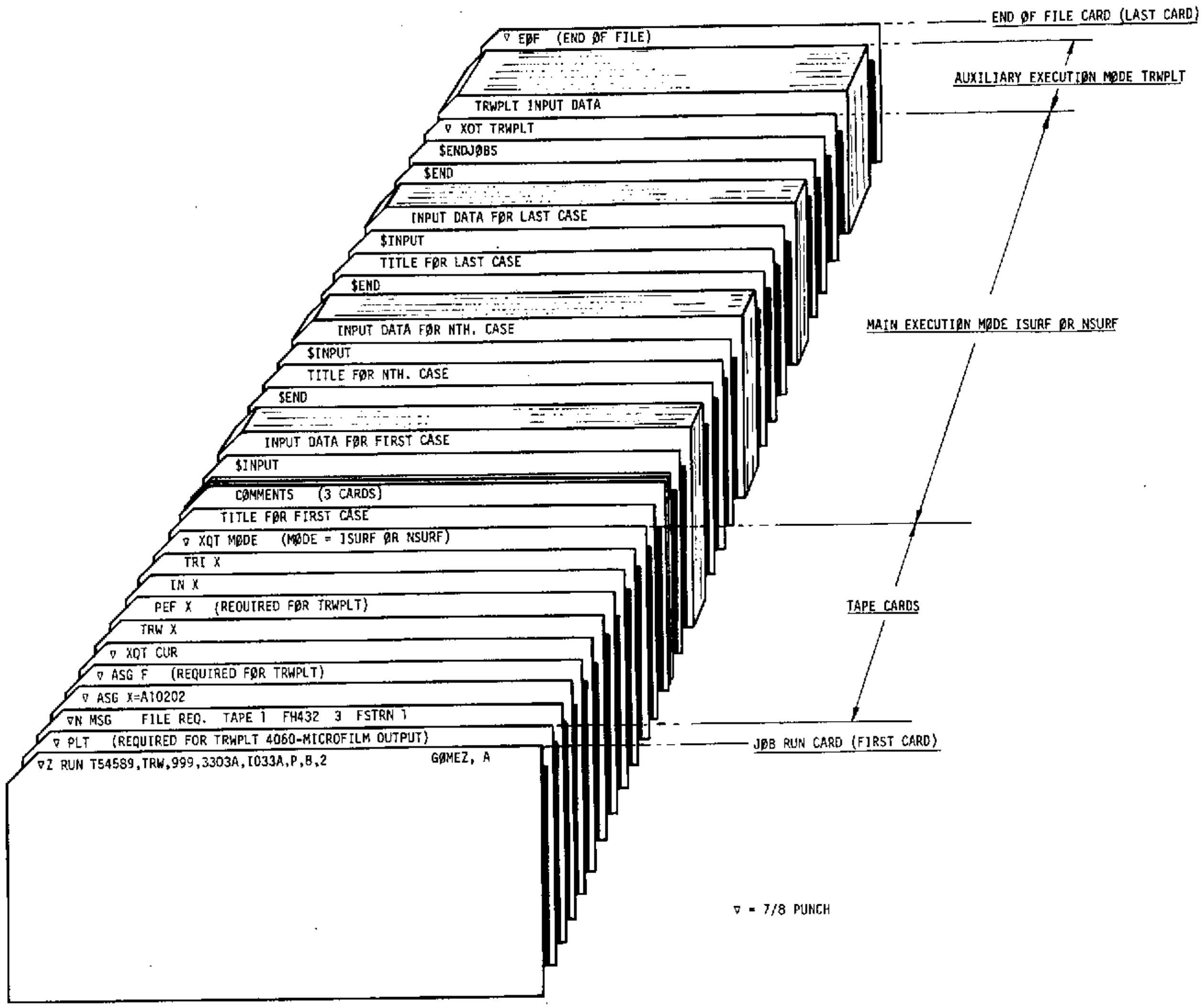


FIGURE 7.02 - CONTROL DECK SETUP

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7.1 Operating Procedures (Continued)

The program overlay diagram for the main and test execution modes is presented in Figure 7.01 (Page 7-2). The program control deck setup is illustrated in Figure 7.02 (Page 7-3).

7.2 Execution Time

For the main execution modes of the program, i.e., XQT ISURF or XQT NSURF, the execution time required to complete a single case is primarily dependent on the total number of vortices or elemental surfaces that are considered simultaneously in arriving at a solution. The other factors that affect the execution time are due to the execution of the special options of the program, such as: ground effects, lifting-line extrapolated solutions, tape output, surface discontinuities (flaps or tabs), and the execution of XQT TRWPLT, the auxiliary mode of execution, for obtaining Calcomp or 4060-microfilm plots. A simple but approximate estimate of the total execution time for completing a given job may be determined using:

$$t_{(seconds)} = \Delta T_1 + N_C \times (N_g \times \Delta T_{2(N_M)}) + N_P \times \Delta T_3 \tag{7.2.01}$$

$$N_M = N_S \times \sum_{n=1}^{\text{No. Surfaces}} N_{e,n} \tag{7.2.02}$$

where:

ΔT_1	= 20	Time required (seconds) to load the program.
ΔT_2	=	Time required (seconds) to obtain a single vortex-lattice solution (see Figure 7.03).
ΔT_3	= 10	Time required (seconds per plot) for the XQT TRWPLT execution
N_C	=	Number of cases to complete job.
N_g	= 1	No ground effects.
	= 2	With ground effects.
N_p	=	Number of plots.
N_M	=	Number of elements in the vortex-lattice matrix.
N_S	= 1	Unsymmetric loading.
	= 0.5	Symmetric loading
$N_{e,n}$		Number of elemental panels for the nth, surface

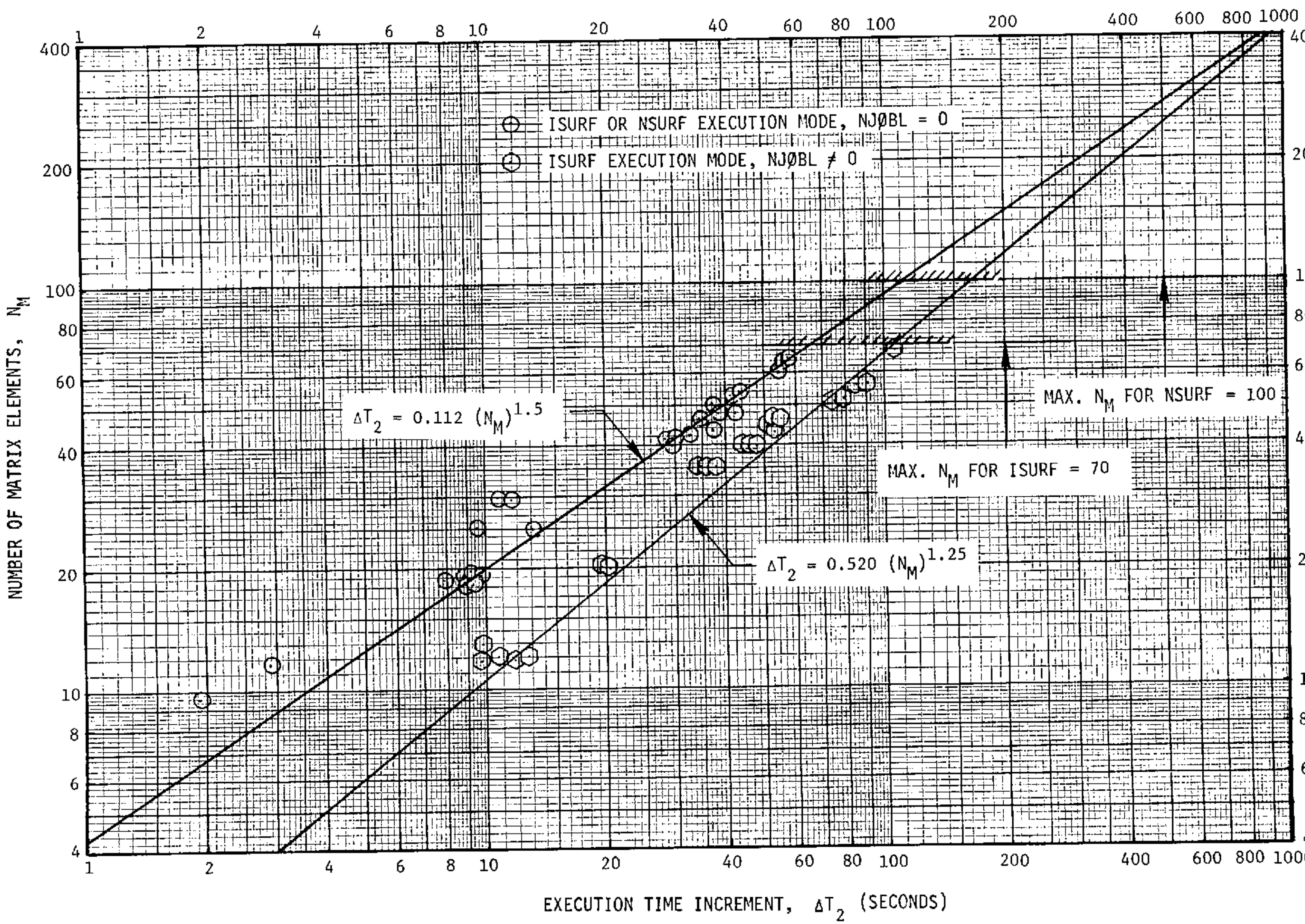

FIGURE 7.03 - EXECUTION TIME INCREMENT ΔT_2

7.3 Program Organization

The present version of the "TRW Vortex-Lattice Analysis Program #HA010B (N.SURFACE)" that is described in this report constitutes an expanded and modified version that was derived from two older prototype programs., i.e., "TRW's Single Surface Vortex-Lattice Analysis Program #HA009A/B (ISURF)," and "TRW's Multiple Surface Vortex-Lattice Analysis Program #HA010A (NSURF)." The prototype programs were developed specifically for analyzing single-surface and multiple-surface configurations respectively. The present version (HA010B) incorporates the same analytical procedures and basically the same source-program code found in the prototype programs and differs only in the input and output format that is used. In addition, the "TRW Generalized Plot Program TRWPLT (Reference 35)" is included in the PCF tape for providing Calcomp and 4060-microfilm plot-output. Five separate modes of execution are permitted (see Section 7.1) that include: (1) two main execution modes for solving lifting-surface problems by the vortex-lattice method, (2) two test execution modes for determining the accuracy of the matrix inversion procedures, and (1) one auxiliary execution mode that is used for obtaining Calcomp or 4060-microfilm output. The source program (absolute and symbolics) in the program PCF tape is arranged in the following form:

1st. File	2nd. File	3rd File
(No Plots)	(With Plots)	(Backup)
NSURF	NSURF	NSURF
ISURF	ISURF	ISURF
NSURFT	NSURFT	NSURFT
ISURFT	ISURFT	ISURFT
-	TRWPLT	TRWPLT

The source program for each of the main execution modes (XQT NSURF or SQT ISURF) is organized in the following manner: one main (driver) routine, one block data (initial values) subroutine, one-vortex-lattice-geometry calculation subroutine, one vortex-lattice-solution calculation subroutine, and a number of special purpose calculation subroutines. The functions performed by each category are as follows:

7.3 Program Organization (Continued)

Main (Driver) Routine

1) Read input data (Unit 5) for all cases to be executed and store the input data in a drum file (Unit 1) for later use and initiate calculations by calling the block data subroutine.

2) Read data for the first case (or subsequent cases) from the data drum file (Unit 1).

3) Call the vortex-lattice-geometry calculation subroutine for determining all the geometric parameters that will be needed.

4) Setup angle of attack loop and multiple-surface loop (if applicable) and proceed to obtain the vortex-lattice-solutions by calling the vortex-lattice-solution calculation subroutine.

5) Finalize the first case (or subsequent case) by printing the execution elapsed time and the number of plot files created. Go back to #2 and start the execution of the next case.

Block Data (Initial Values) Subroutine

1) Stores data for the initial values (built-in Tables, see Section 4).

Vortex-Lattice-Geometry Calculation Subroutine

1) Calculate the geometry of the vortex-lattice for all the lifting surfaces that are defined in the input.

2) Calculate the geometric parameters that define each lifting surface, e.g., the lifting surface reference dimensions.

3) Output the calculated geometry for each lifting surface.

4) Output on tape (Unit 8) the geometry for each lifting-surface using the special format required for the plotting option (XQT TRWPLT).

6

Vortex-Lattice-Solution Calculation Subroutine

1) Calculate the influence coefficient matrix.

2) Invert the influence coefficient matrix and determine the vorticity or circulation for all the vortex-filaments of the lifting surfaces that are considered simultaneously.

3) Calculate the airload distribution on each lifting surface and perform all the required summations.

4) Calculate the section-airload coefficients and output same as printed output and on tape (Unit 8) if applicable.

5) Finalize the calculations by printing the spatially-integrated airloads for each lifting surface and the net airload summations.

Special Purpose Calculation Subroutines

1) Perform calculations directed towards a limited objective.

The program logic flow diagrams for the main (driver) routine and the principal subroutines of the program are presented in Figures 7.04 through 7.09 following Section 7.5. A description of the functions performed by each individual routine are presented in Sections 7.4 and 7.5.

7.4 Program Routines for XQT NSURF

1) MAIN RØUTINE (A01) (237 FORTRAN Statements)

This is the main routine or driver routine for the XQT NSURF execution mode of the program that performs solutions for multiple-lifting-surfaces problems by the vortex-lattice method.

2) SUBRØUTINE BLKDAT (A02) (55 FORTRAN Statements)

This is a block data routine where the initial values (built-in tables) of selected input variables are stored (see Section 4.0).

3) SUBRØUTINE LØFT (A03) (864 FORTRAN Statements)

Subroutine LØFT constitutes the vortex-lattice geometry calculation routine. In this routine all the geometry calculations are carried out. It includes the setup of the vortex-lattice field point coordinates, unit vectors, areas, etc., and the calculation of the reference dimensions

for each lifting surface that is input. Also, as a special option (NFLG(19) $\neq$ 0), the geometry of the vortex-lattice is output on tape or any specified internal unit which is used as the input data-tape in the execution of XQT TRWPLT for generating Calcomp/4060-microfilm plot-output.

4) SUBRØUTINE LIFTX (A04) (1,178 FORTRAN Statements)

This is the vortex-lattice-solution calculation subroutine for multiple-surface analysis (XQT NSURF). In this subroutine all the calculations directed towards obtaining a solution for a given vortex-lattice originate, that include: calculate influence coefficients, calculate the circulation strength of the vortex-filaments, etc. In addition, the section airload coefficients, lift distribution, and spatially-integrated sums of airload force and moments are performed.

5) SUBRØUTINE ABØRTJ (A05) (92 FORTRAN Statements)

All diagnostic and job termination output originates in this subroutine. Tests are performed in this routine for selected key variables during the execution and if unallowable errors are incurred the job execution is aborted.

6) SUBRØUTINE CØRDF (A06) (60 FORTRAN Statements)

This routine calculates the planform dimensions at a wing station for a lifting surface, e.g., Y, X_{LE}, X_{TE}, C, C_f, C_{tab}, etc., as a function of a function of a dummy argument W.

7) SUBRØUTINE CAMBER (A07) (53 FORTRAN Statements)

Subroutine CAMBER determines the normal coordinate of the median camber line of an airfoil, i.e., Z_a/C as a function of X_a/C.

8) SUBRØUTINE FLAPS (A08) (169 FORTRAN Statements)

This routine together with Subroutine FLAPI is used to update the coordinate and unit normal vector (no deflection) of a field point on the surface of a lifting-surface due to flap and/or trim-tab deflection.

9) SUBRØUTINE FLAPI (A09) (28 FORTRAN Statements)

See Subroutine FLAPS (#8).

10) SUBRØUTINE REFLEC (A10) (53 FORTRAN Statements)

Subroutine REFLEC calculates the coordinates of a mirror image of a field point using the ground plane as the mirror plane. It is used in the ground effect analysis for determining the coordinates of the image vortex-lattice.

11) SUBRØUTINE ISØMET (A11) (27 FORTRAN Statements)

It transforms the coordinates of a given field point (P(X,Y,Z) to a new coordinate system P(X',Y',Z') that is used to obtain an isometric projection of the vortex-lattice.

12) SUBRØUTINE RØTATE (A12) (45 FORTRAN Statements)

It transforms the coordinates of a given field point P(X,Y,Z) to a new coordinate system P(X',Y',Z') involving a prescribed rotation and translation.

13) SUBRØUTINE VØRTEX (A13) (189 FORTRAN Statements)

Subroutine VØRTEX calculates the induced velocity or influence coefficient $\vec{\psi}$ for a field point P(X,Y,Z) due to a skew-shaped horshoe vortex filament of circulation strength Γ defined by the field points B(X,Y,Z) and D(X,Y,Z).

14) SUBRØUTINE DMATIN (A14) (149 FORTRAN Statements)

Subroutine DMATIN is a double precision, 100 x 100, matrix inversion routine.

15) SUBRØUTINE DØTP (A15) (17 FORTRAN Statements)

It calculates the dot-product of two vectors.

16) SUBRØUTINE CRØSP (A16) (20 FORTRAN Statements)

It calculates the vector cross-product of two vectors.

17) SUBRØUTINE PAGE (A17) (43 FORTRAN Statements)

This subroutine causes a new page to be started and the job title and job execution flags to be printed at the top of the page in the program execution.

7.5 Program Routines for XQT ISURF

18) MAIN RØUTINE (B01) (211 FORTRAN Statements)

Same as #1 (A01) except the solution for a single-lifting-surface is considered exclusively.

19) SUBRØUTINE BLKDAT (B02) (55 FORTRAN Statements)

Same as #2 (A02) except the solution for a single-lifting-surface is considered exclusively.

20) SUBRØUTINE LØFT (B03) 935 FORTRAN Statements)

Same as #3 (A03 except the solution for a single-lifting-surface is considered exclusively.

21) SUBRØUTINE DLIFT (B04) (699 FORTRAN Statements)

Same as #4 (A04) except the solution for a single-lifting-surface is considered exclusively.

22) SUBRØUTINE INTERP (B05) (406 FORTRAN Statements)

Subroutine INTERP is used to calculate coefficients from two exact vortex-lattice solutions at different angles of attack. These coefficients are used to generate arrays of approximate solutions that are based on the lifting-line theory linearized analysis technique.

23) SUBRØUTINE DLINER (B06) (601 FORTRAN Statements)

Subroutine DLINER calculates arrays of approximate solutions using the coefficients determined by INTERP.

24) SUBRØTINE SPANI (B07) (125 FORTRAN Statements)

This routine is used to calculate constant and variable span spacing of the vortex-lattice elemental panels.

25) SUBRØUTINE CHØRDI (B08) (77 FORTRAN Statements)

Subroutine CHØRDI calculates constant or cosine spacing of the vortex-lattice elemental panels in the chordwise direction.

26) SUBRØUTINE CHØRDT (B09) (44 FORTRAN Statements)

Same as #6 (A06) except the presence of a trim-tab has been omitted.

7.5 Program Routines for XQT ISURF (Continued)

27) SUBRØUTINE FLAPS (B10) (93 FORTRAN Statements)

Same as #8 (A08) except the presence of a trim-tab has been omitted.

28) SUBRØUTINE VØRTEX (B11) (190 FORTRAN Statements)

Equivalent to #13 (A13).

29) SUBRØUTINE REFLEC (B12) (50 FORTRAN Statements)

Equivalent to #10 (A10)

30) SUBRØUTINE DMATIN (B13) (149 FORTRAN Statements)

This is a double precision, 70 x 70, matrix inversion routine.

31) SUBRØUTINE DØTP (B14) (18 FORTRAN Statements)

Equivalent to #15 (A15).

32) SUBRØUTINE CRØSP (B15) (21 FORTRAN Statements)

Equivalent to #16 (A16).

33) SUBRØUTINE RØTATE (B16) (46 FORTRAN Statements)

Equivalent to #12 (A12).

34) SUBRØUTINE CURFIT (B17) (103 FORTRAN Statements)

The CURFIT routine calculates the coefficients of cubics that are used by the CURVE subroutine.

35) SUBRØUTINE CURVE (B18) (58 FORTRAN Statements)

Using the coefficients of cubics calculated by the CURFIT subroutine, the subroutine CURVE determines the value and the derivative of a given function at selected values of the independent variable. CURVE together with CURFIT constitute a spline point (cubic), continuous derivative, interpolation procedure used in the program.

36) SUBRØUTINE PAGE (B19) (40 FORTRAN Statements)

Same as #17 (A17), except, the title and the job execution flag IFLG used in XQT ISURF are output.

7.6 Program Routines for XQT NSURFT and ISURFT

37) MAIN RØUTINE (A18) (76 FORTRAN Statements)

This routine performs a matrix-inversion test by calculating the inverse-matrix and the unit-matrix using the values of a 5 x 5 built-in matrix.

38) MAIN RØUTINE (B20) (76 FORTRAN Statements)

Equivalent to #37 (A18).

7.7 Program-Logic Flow Diagrams

The program-logic flow diagrams for the main (driver) routines and the most important calculation routines that are used in the main execution modes (XQT NSURF and XQT ISURF) are presented in Figures 7.04 through 7.06 (see Pages 7.14 through 7.19).

A) MAIN ROUTINE (A01)

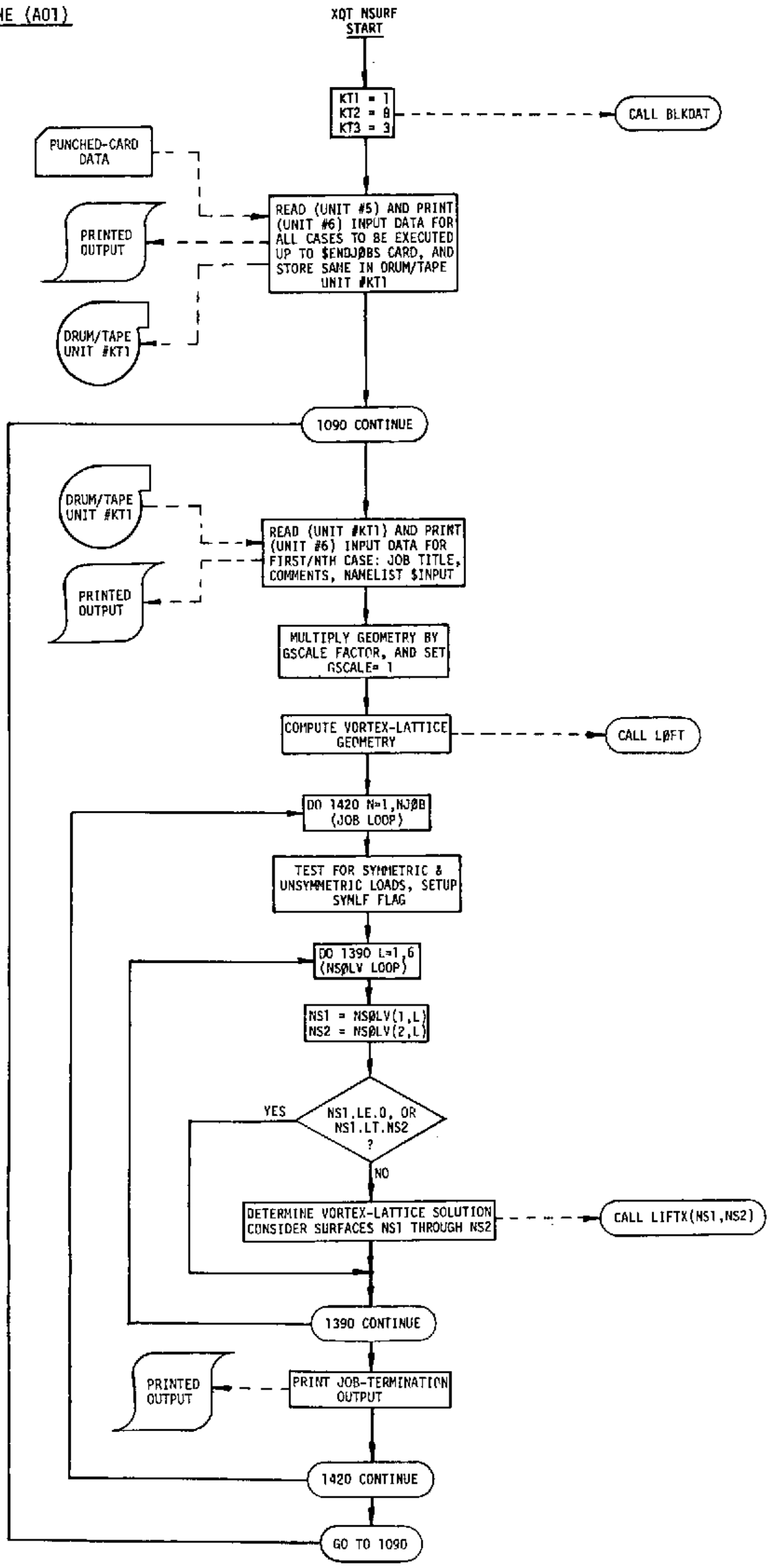

FIGURE 7.04 - LOGIC-FLOW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES (PROGRAM HA010B)

B) MAIN ROUTINE (B01)

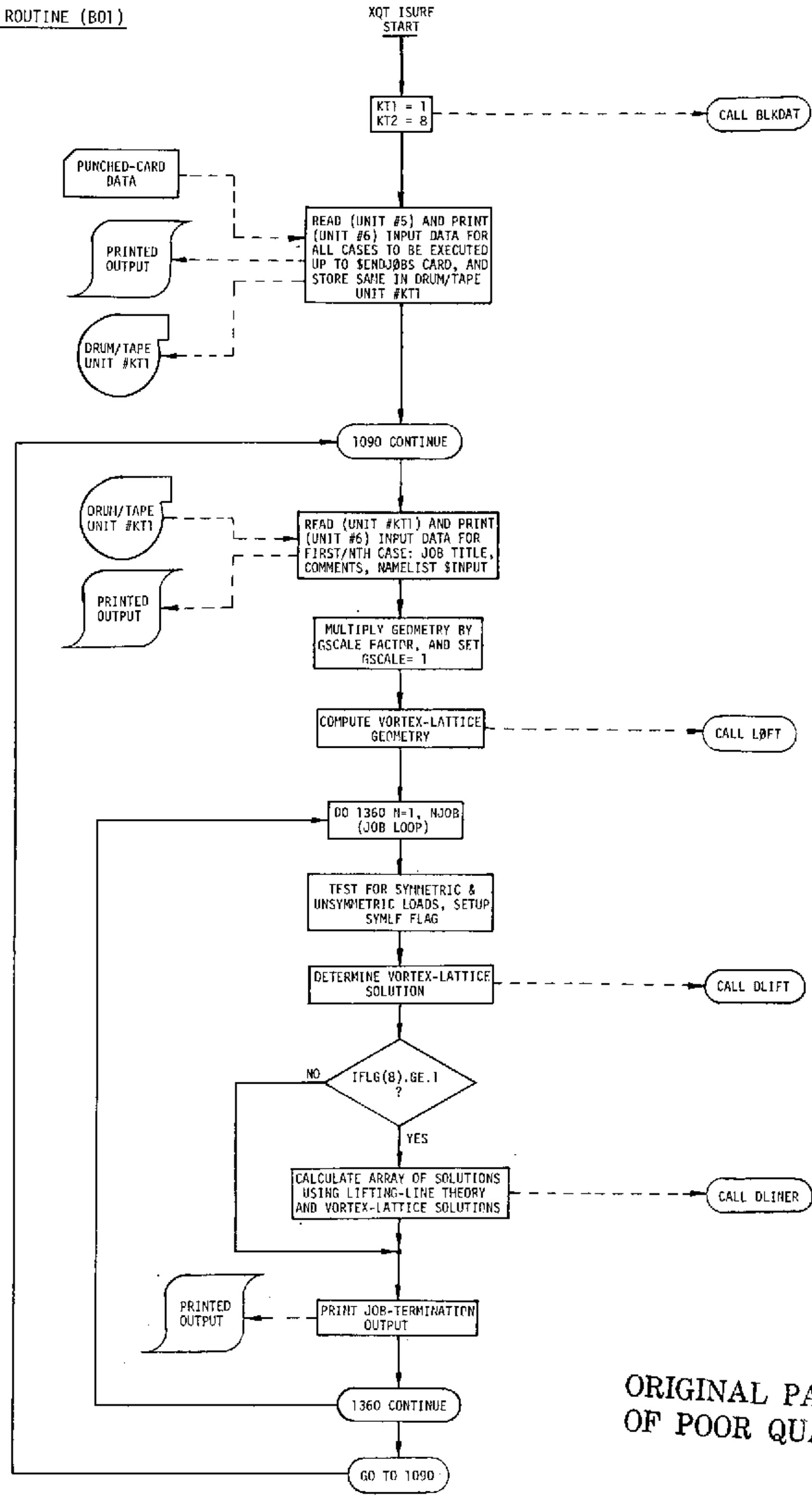

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FIGURE 7.04 - LOGIC-FLOW-DIAGRAMS FOR THE MAIN (DRIVER) EXECUTION ROUTINES (PROGRAM HA01OB) [CONTINUED]

A) SUBROUTINE LØFT (A03)

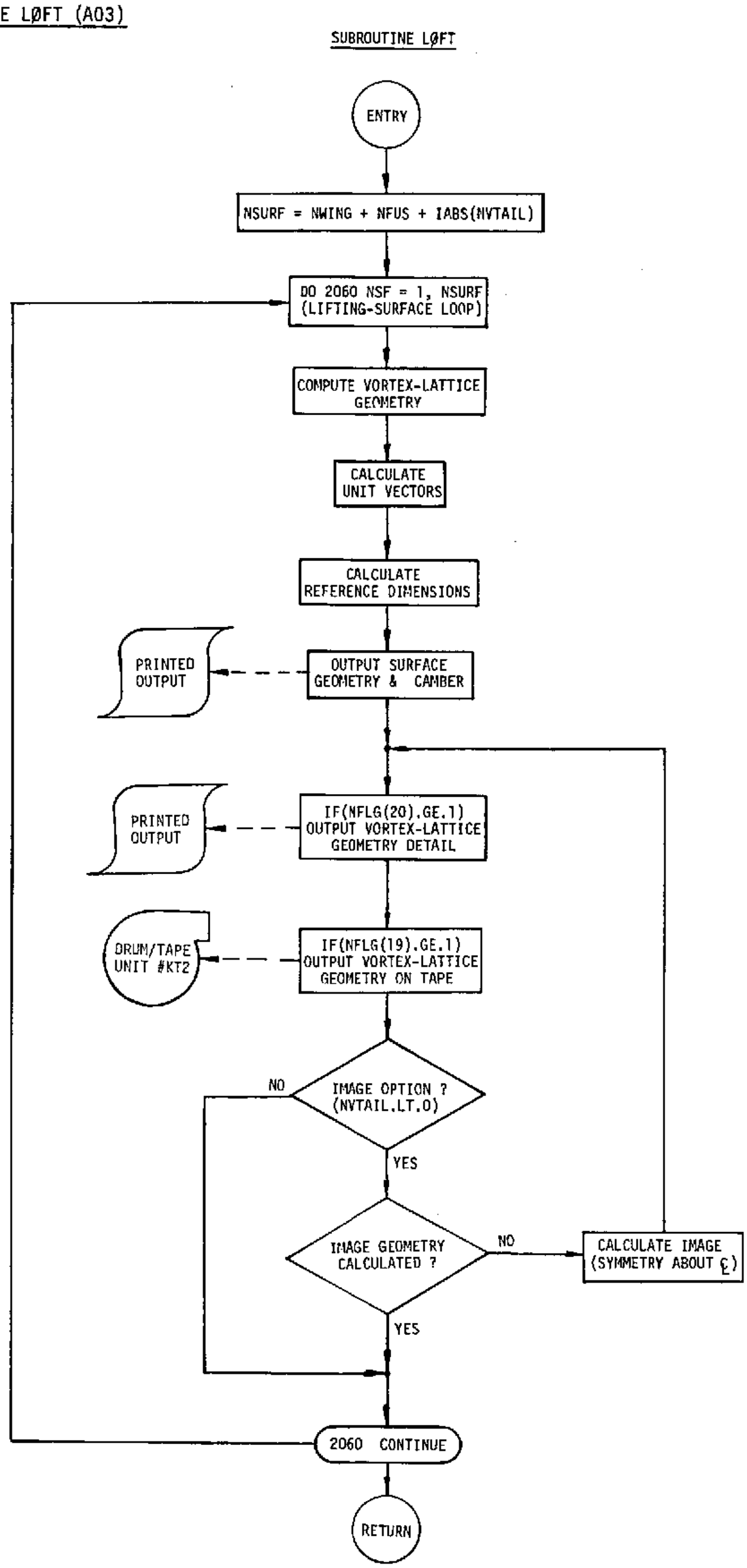

FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION ROUTINES (PROGRAM HA010B)

B) SUBROUTINE LOFT (B03)

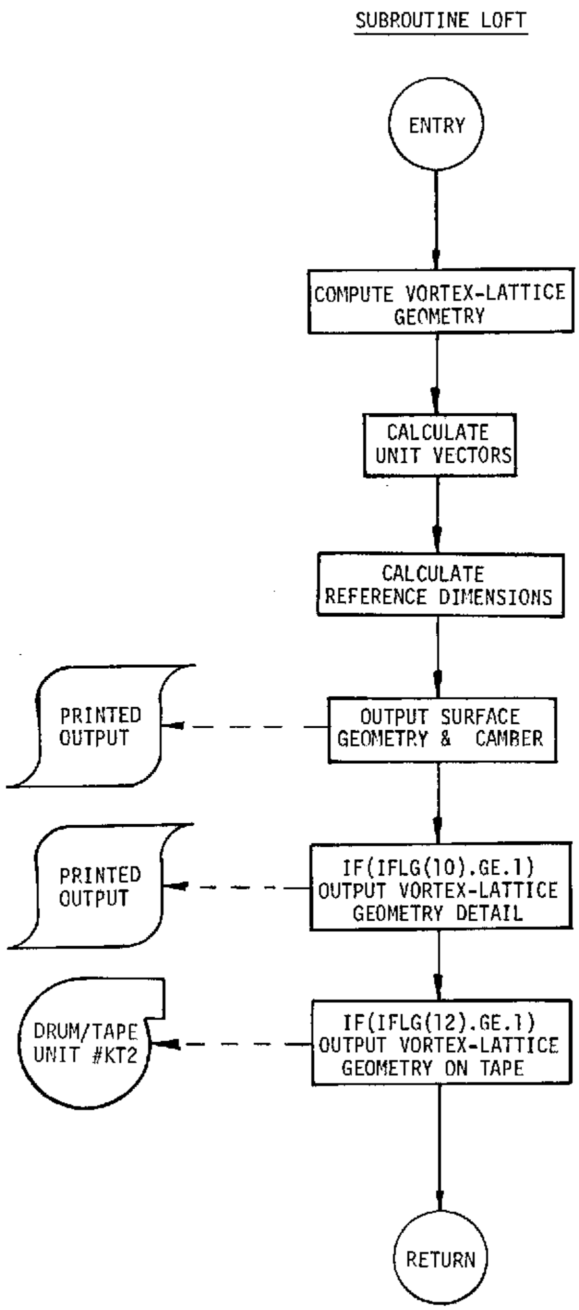

FIGURE 7.05 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE GEOMETRY CALCULATION ROUTINES (PROGRAM HA010B) [CONTINUED]

4) SUBROUTINE LIFTX (A04)

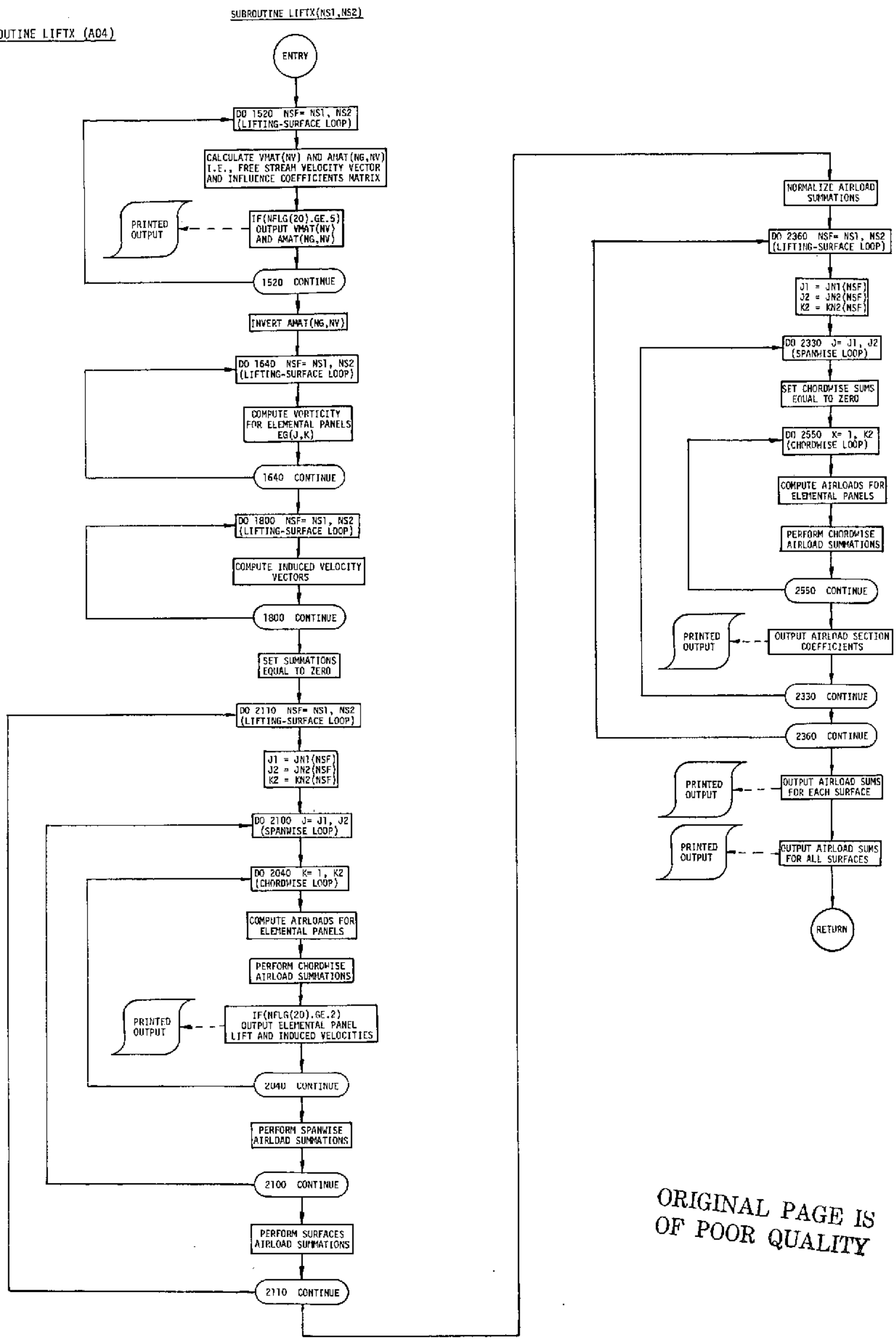

FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION ROUTINES (PROGRAM HA010B)

B) SUBROUTINE DLIFT (R04)

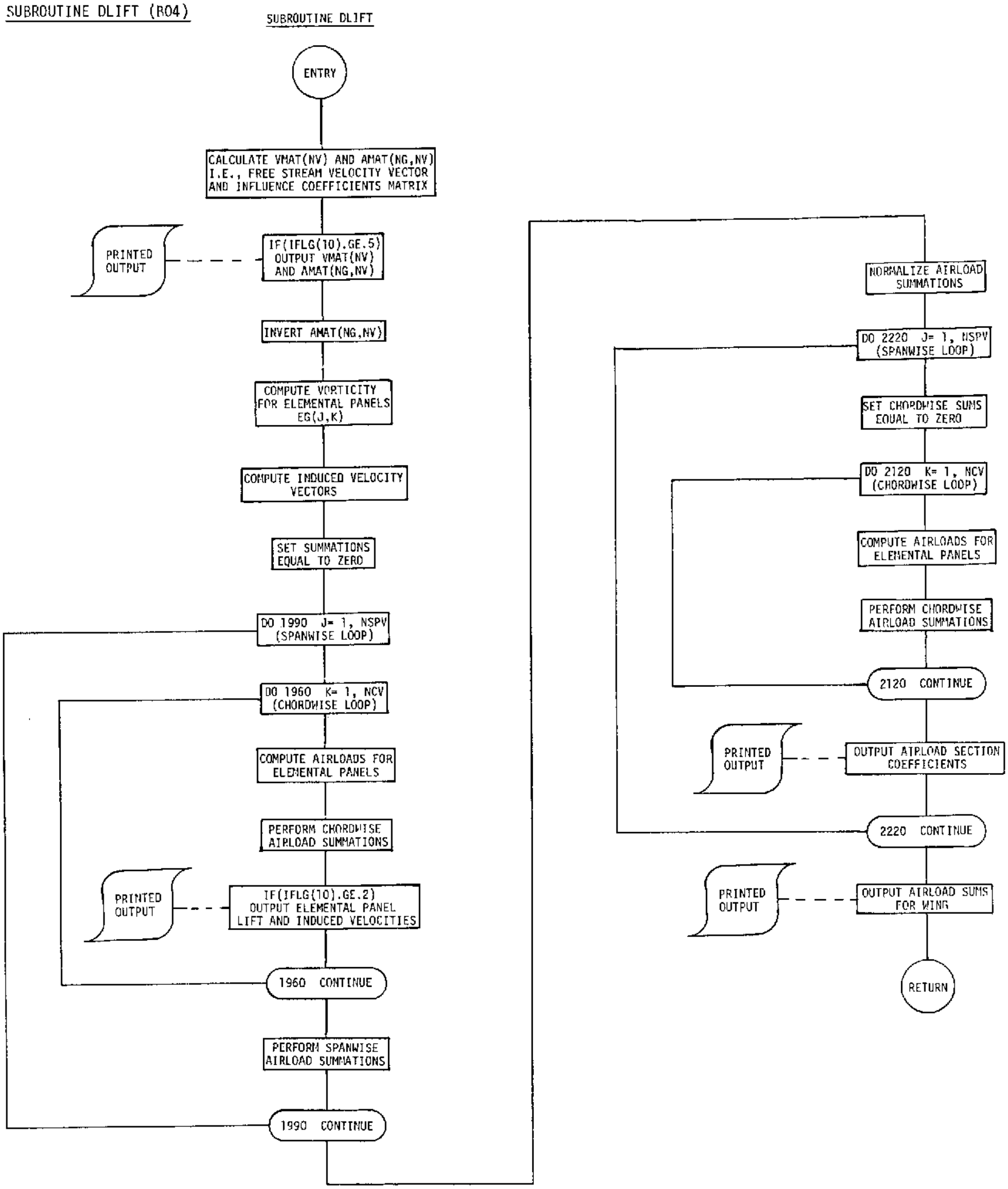

FIGURE 7.06 - LOGIC-FLOW-DIAGRAMS FOR THE VORTEX-LATTICE SOLUTION CALCULATION ROUTINES (PROGRAM HA010B) [CONTINUED]

8.0 REFERENCES

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9.0 SOURCE-PROGRAM LISTING

```
∇ MAP NSURF,NSURF
      SEG A01-A02-A03-A04-A05-A06-A07-A08-A09-A10-A11-A12-A13-A14-,
          A15-A16-A17


∇ MAP ISURF,ISURF
      SEG B01-B02-B03-B04-B05-B06-B07-B08-B09-B10-B11-B12-B13-B14-,
          B15-B16-B17-B18-B19


∇ MAP NSURFT,NSURFT
      SEG A18-A14-A17


∇ MAP ISURFT,ISURFT
      SEG B20-B13-B19


∇ FOR A01,A01
C
C
C
C    * MAIN ROUTINE N-SURFACE VORTEX LATTICE ANALYSIS PROGRAM HA010B-71*
C
C    * THEORY AND PROGRAM DEVELOPED BY ANTULIO V. GOMEZ,STAFF ENGINEER *
C    * TRW SYSTEMS GROUP, DIVISION OF TRW INC., HOUSTON, TEXAS - 77058 *
C    * VERSION 2 ROUTINE (DOUBLE PRECISSION-LANGLEY MATINV SUBROUTINE) *
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      REAL MACHN(10)
      DIMENSION STORE(14), COMMTS(42)
      DIMENSION WCL(21),ALFA(20),HEIGHT(10)
      DIMENSION SYMLF(5),NSOLV(2,6),NFLG(20)
C
C
      COMMON/DATA00/ TITLE(14), ALFA0, ZH0, CMAK
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
C
      COMMON/DATA03/FLAPDJ(5),TABDJ(5),AILDJ(2,5),DELTF1(5),DELTF2(5)
     1 ,WFF11(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)
     2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)
C
      COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB
C
      EQUIVALENCE (NFLG,IFLG)
C
      NAMELIST/INPUT/KCUT,KT1,KT2,KT3,LINX,NWING,NVTAIL,NFUS,COLOCP
     * ,CUTOF1,CUTOF2
     * ,LFLAP,GSCALE
     * ,NSS,NCS,X,Y,Z,E,C,XOC,ZOC,XOCR
     * ,WFLAP1,WFLAP2,WFLAP3,FLAPC,TABC,WSMOTH
     * ,XCG,YCG,ZCG,REFS,REFC,REFB
     * ,NJOB,ALFA,MACHN,HEIGHT,FLAPDJ,TABDJ,AILDJ
     * ,NFLG,NSOLV
C
C
      DATA TEST/6H $ENDJ/
      DATA NJOB/1/, NJOBL/20/, ALFA/20*0.0/
      DATA WCL/1.0,  -0.4,-0.3,-0.2,-0.1,0.0,0.1,0.2,0.3,0.4,0.5,0.6,
     *  0.8,0.9,1.0,1.1,1.2,1.3,1.4,1.5,1.6/
      DATA MACHN/10*0.0/, HEIGHT/10*10000.0/
      DATA SYMLF/5*0.0/,NSOLV/1,1,10*0/
C
C
 1000 FORMAT(13A6,A2)
C
 1010 FORMAT(//,15X,14H**** JOB TIME=,I4,16H / ELAPSED TIME=,I4,
     1 17H / NO.PLOT FILES=,I4,35H / NSURF EXEC. VERSION 6-18-72 ****,
     2 //,15X,47(2H**),/,15X,47(2H**) )
C
 1020 FORMAT(1H1,10X,35H**** JOBS INPUT LIST-CONTINUED ****,/,1X )
 1030 FORMAT(1X,13A6,A2)
 1040 FORMAT(1X,11H7 XQT NSURF)
C
 1050 FORMAT(1H1,///,///,29X,
     1 53HSUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B,//,37X,
     2 36HTRW SYSTEMS INC., HOUSTON OPERATIONS,//,44X,
     3 22HHOUSTON, TEXAS (77058),///,16X,
     4 25H**** JOBS INPUT LIST ****,/, 1X )
C
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      CALL BLKDAT
      REWIND KT1
      WRITE (KOUT,1050)
```

∇ = 7/8 PUNCH

ORIGINAL PAGE IS OF POOR QUALITY

```
      WRITE (KOUT,1050)
      WRITE (KOUT,1040)
      LIN=15
 1060 READ (KIN,1000)(STORE(I),I=1,14)
      WRITE (KT1,1000)(STORE(I),I=1,14)
      IF (LINX-LIN) 1070,1080,1080
 1070 WRITE (KOUT,1020)
      LIN= 3
 1080 LIN= LIN +1
      WRITE (KOUT,1030)(STORE(I),I=1,14)
C
      IF (STORE(1).NE.TEST) GO TO 1060
      END FILE KT1
      REWIND KT1
      WRITE (KOUT,1040)
C
      NCOMT=-1
      NCALCP= -1
      ISUM = 0.0
      GSCALE= 1.0
C
      CALL RESET
C
C
 1090 READ (KT1,1000)(TITLE(I),I=1,14)
      IF(TITLE(1).EQ.TEST) CALL EXIT
      IF (NCOMT) 1100,1100,1110
 1100 READ (KT1,1000)(COMMTS(I),I=1,42)
 1110 NCOMT= 1
      READ (KT1,INPUT)
C
      IF (NCALCP) 1120,1120,1140
 1120 NCALCP= 1
 1130 REWIND KT2
 1140 CONTINUE
C
      NSURF= NWING +NFUS +IABS(NVTAIL)
      NSYM = NWING + NFUS
      DO 1160 NSF=1,NSURF
      SYMLF(NSF) = 0.0
      IF (NSYM-NSF) 1150,1160,1160
 1150 SYMLF(NSF) = 1.0
 1160 CONTINUE
C
C
      ALFAD= 0.0
      ZHO  = 10000.0
      CMAK = 0.0
C
      XCG = GSCALE*XCG
      YCG = GSCALE*YCG
      ZCG = GSCALE*ZCG
      REFC= GSCALE*REFC
      REFB= GSCALE*REFB
      REFS= GSCALE*GSCALE*REFS
C
      IF (WSMOTH-1.0) 1180,1180,1170
 1170 WSMOTH= WSMOTH*GSCALE
 1180 CONTINUE
C
      DO 1240 N=1,5
      IF (WFLAP1(N)-1.0) 1200,1200,1190
 1190 WFLAP1(N) =  WFLAP1(N)*GSCALE
 1200 IF (WFLAP2(N)-1.0) 1220,1220,1210
 1210 WFLAP2(N) =  WFLAP2(N)*GSCALE
 1220 IF (WFLAP3(N)-1.0) 1240,1240,1230
 1230 WFLAP3(N) =  WFLAP3(N)*GSCALE
 1240 CONTINUE
C
      JX= NSS(NSURF)
      DO 1270 K=1,10
      DO 1260 J=1,JX
      IF (IFLG(16)) 1260,1260,1250
 1250 ZOC(K,J)= ZOC(K,J)/C(J)
 1260 CONTINUE
 1270 CONTINUE
C
      DO 1310 J=1,30
      X(J) = X(J)*GSCALE
      Y(J) = Y(J)*GSCALE
      Z(J) = Z(J)*GSCALE
      C(J) = C(J)*GSCALE
      IF (FLAPC(J)-1.0) 1290,1290,1280
 1280 FLAPC(J)= FLAPC(J)*GSCALE
 1290 IF (TABC(J)-1.0) 1310,1310,1300
 1300 TABC(J) = TABC(J)*GSCALE
 1310 CONTINUE
C
      GSCALE= 1.0
C
C
      CALL PAGE
      WRITE (KOUT,INPUT)
C
C
C
      CALL LOFT
C
C
      DO 1420 N=1,NJOB
C
      ALFAD= ALFA(N)
      HEIGT= HEIGHT(N)
      ALFAD= ALFAD
      ZHO  = HEIGT
      CMAK = 0.0
```

```
      EXECK(1)= 1.0
      IF (MACHN(N)-0.95) 1320,1320,1330
 1320 CMAK = MACHN(N)
C
      CALL ABORTJ(5,CMAK,N)
C
      EXECK(1)= SQRT(1.0-CMAK**2)
 1330 CONTINUE
C
C
      DO 1390 L=1,6
      NS1= NSOLV(1,L)
      NS2= NSOLV(2,L)
      IF (NS2) 1390,1390,1340
 1340 CONTINUE
C
      TEST = 0.0
      DO 1350 M=NS1,NS2
      SYMLF(M)= 0.0
 1350 TEST= TEST + ABS( AILDJ(1,M) - AILDJ(2,M) ) -0.01
      IF (TEST) 1380,1380,1360
 1360 CONTINUE
      DO 1370 M=NS1,NS2
 1370 SYMLF(M)= 1.0
 1380 CONTINUE
C
C
      CALL LIFTX(ALFAD,HEIGT,SYMLF,NS1,NS2)
C
C
 1390 CONTINUE
C
C
      CALL TIME(IMS)
      IS= IMS/1000
      ISJB= IS-ISUM
      ISUM= IS
C
      LIN= LIN+6
      IF (LINX-LIN) 1400,1410,1410
 1400 CALL PAGE
 1410 WRITE (KOUT,1010)ISJB,IS,KFILE
      LIN= LIN + LINX
C
 1420 CONTINUE
C
      GO TO 1090
C
C
      END


 ∇ FOR A02,A02
C
C
      SUBROUTINE BLKDAT
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
C
      COMMON/DATA00/ TITLE(14), ALFA0, ZHO, CMAK
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
C
      COMMON/DATA03/FLAPDJ(5),TABDJ(5),AILDJ(2,5),DELTF1(5),DELTF2(5)
     1 ,WFF11(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)
     2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)
C
      COMMON/DATA04/ WINGD(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5),NSURF
     1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10)
     2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,3)
C
      COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB
C
C     xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
C
      DATA KIN/5/, KOUT/6/, KT1/1/, KT2/8/, KT3/3/, KREC/0/, KFILE/0/
     1,LIN/0/, LINX/56/, RAD/57.2958/, PIE/3.14159/, CUTOF1/0.0001/
     2,CUTOF2/0.0029/, DELALF/1.0/, LFLAP/0/, LDRAG/0/, COLOCP/0.75/
     3,IFLG/10,0,0,0,0, 4,0,0,0,0, 5*0, 0,0,1,0,4/,EXECK/15*0.0/
C
      DATA NWING/1/,NFUS/0/,NVTAIL/0/, NSS/2,4*0/,NSSO/1,4*0/,NCS/2,4*0/
     1,X/30*0.0/,Y/0.0,1000.0,28*0.0/,Z/30*0.0/,E/30*0.0/,C/100.0,100.0
     2,28*0.0/,XOCR/30*0.25/,FLAPC/30*0.25/,TABC/30*0.125/
     3,WSMOTH/0.10/, XOC/0.0,1.0,48*0.0/,ZOC/300*0.0/
C
      DATA FLAPDJ/5*0.0/,TABDJ/5*0.0/,AILDJ/10*0.0/
      DATA WFLAP1/5*0.0/,WFLAP2/5*0.60/,WFLAP3/5*1.00/
C
      DATA XCG/0.0/,YCG/0.0/,ZCG/0.0/,REFS/1000.0/,REFC/100.0/
     1 ,REFB/100.0/
C
C     xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
C
      RETURN
C     XXXXXX
```

```
C
      END


V FOR A03,A03
C
      SUBROUTINE LOFT
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION COS1(3),COS2(3),COS3(3)
      DIMENSION DUMYF(10)
C
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
      COMMON/DATA22/IMAGEF(5),JSINGP(5)
C
      COMMON/DATA03/FLAPOJ(5),TABOJ(5),AILOJ(2,5),DELTF1(5),DELTF2(5)
     1 ,WFF11(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)
     2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)
C
      COMMON/DATA04/ WINGD(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5),NSURF
     1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10)
     2 ,EN(60,10,6), EV(60,10,6), VVINOX(60,10,3)
C
      COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
 1000 FORMAT(1X,//,1X)
C
 1010 FORMAT(50X,19HLIFTING SURFACE NO=,I2,/,50X,21(1H*),///,1X,
     1 60H     SPAN       ROOT       TIP       ROOT       TIP       AREA ,
     2 59H    ASPECT     MEAN       MGC       YBAR       XBAR      ZBAR,/,
     361H               CHORD      CHORD      TWIST      TWIST           ,
     4 60H     RATIO     CHORD      (MAC)      (MGC)      (MGC)     (MGC),/
     5/,1X,3F10.3,2F10.4,F10.2,F10.4,5F10.3,//,1X,
     6 60H     FLAP       FLAP       FLAP       FLAP       TAB       L.AIL ,
     7 60H     R.AIL      DIHED.     SWEEP     NO.SPAN    NO.CHORD  NO.CHORD,/
     8,61H       SPAN1      SPAN2      SPAN3      DEFLEC     DEFLEC    DEFLEC,
     9 60H     DEFLEC     MGC/4      MGC/4     ELEMENTS   ELEMENTS  DISCONT.,
     */,1X,9F10.3,I7,2I10,//,34X,
     1    56HFUS STA   WING STA    WL STA      AREA       CHORD      SPAN ,/,
     234X,56H X(CG)      Y(CG)      Z(CG)      S(CG)      C(CG)     B(CG),/,
     331X,6F10.3,///,1X)
C
 1020 FORMAT(1X)
C
 1030 FORMAT(1X,
     1 60H    WS          Y          Z         X(LE)      X(C/4)     X(TE)    ,
     2 60H   TWIST     DIHE(C/4) SWEP(C/4)  C(WING)    C(FLAP)    C(TAB)    ,
     3 /,1X)
 1040 FORMAT( 1X, 12F10.3 )
C
 1050 FORMAT(21X,50H    XA(1)/C    XA(2)/C    XA(3)/C    XA(4)/C    XA(5)/C,
     1 50H    XA(6)/C    XA(7)/C    XA(8)/C    XA(9)/C   XA(10)/C,//,21X,
     2 10F10.4,///,1X,      40H          X          Y        ZA(1)/C    ZA(2)/C,
     3 60H    ZA(3)/C    ZA(4)/C    ZA(5)/C    ZA(6)/C    ZA(7)/C    ZA(8)/C,
     4 20H    ZA(9)/C   ZA(10)/C,/,1X )
 1060 FORMAT( 1X,12F10.4 )
C
 1070 FORMAT(3X,4HJ  K,    40H          Y          Z          WL          EW     ,
     1,30H     DWL        DC         DS    ,/,1X)
 1080 FORMAT(1X,2I3,12(1PE10.3) )
C
 1090 FORMAT(3X,1HJ,2X,1HK,5X,2HXV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YV,7X,
     * 3H1ZV,7X,2HXN,8X,2HYN,8X,2HZN,8X,3H1XN,7X,3H1YN,7X,3H1ZN,/,1X)
 1100 FORMAT( 1X, 2I3, 12(1PE10.3)    )
C
 1110 FORMAT(5X,1HB,9X,2HCP,8X,2HCT,8X,2HER,8X,2HET,8X,1HS,9X,2HAR,8X,
     * 2HMC,8X,3HMGC,6X,4HYMGC,6X,4HXMGC,6X,4HZMGC,/,1X)
 1120 FORMAT(1X,12F10.3 )
C
 1130 FORMAT(1X,/,1X,14H(EDF PLOT FILE,I3,1H)  )
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C *** INITIALIZE ***
C
      XEROX = 0.0
      ZEROX = 0.0
      NWING= NWING + NFUS
      NSURF= NWING + IABS(NVTAIL)
      MFLAG= 100
      IF(NVTAIL.LT.0) MFLAG= NWING +1
      NFUS = 0
C
      CALL ABORTJ(1,XEROX,NSURF)
C
      SUMW = 0.0
C
      NX= 30
      DO 1190 N=1,NX
```

```
      EWE(N)= SUMW
      ELE(N)= X(N) - C(N)*XOCR(N)
      ETE(N)= ELE(N) + C(N)
      CFLAP = FLAPC(N)
      CTAB  = TABC(N)
C
      IF (CFLAP-1.0) 1140,1150,1150
 1140 CFLAP = CFLAP*C(N)
 1150 IF (CTAB-1.0) 1160,1170,1170
 1160 CTAB  = CTAB*C(N)
 1170 CONTINUE
      EHE(N) = ETE(N) - CFLAP
      EHEE(N)= ETE(N) - CTAB
      IF (N-NX) 1180,1190,1190
 1180 N1= N+1
 1190 SUMW = SUMW + SQRT( (Z(N)-Z(N1))**2 + (Y(N)-Y(N1))**2 )
C
      NO = 1
      J1= 0
      DO 1200 N=1,NSURF
      J2= NSS(N)
      CALL ABORTJ(10,J2,J1)
      J1= J2
      NSSO(N)= NO
 1200 NO = NSS(N) +1
      J1 = 1
C
      CALL ABORTJ(6,XEROX,N)
C
C
C *** N-SURFACE LOOP ***
C
      DO 2060 NSF=1,NSURF
C
C
C  ** CALCULATE WETTED LENGTH **
C
      NREPET= 0
      IF(NSF.GE.MFLAG) NREPET= 1
      NSFM1= NSF - 1
      NSF5 = NSF + 5
      NSF10= NSF + 10
      NSPV = IFLG(NSF)
      NCV  = IFLG(NSF5)
      NCDIS= IFLG(NSF10)
      NCVW = NCV - NCDIS
      NSPV1= NSPV + 1
      NCV1 = NCV + 1
      NB = NSS(NSF)
      NO =  NSSO(NSF)
      NK =  NCS(NSF)
      DCORD = 1.0/FLOAT(NCVW)
      IMAGEF(NSF)= NSPV
      JSINGP(NSF)= 0
C
      CALL ABORTJ(3,XEROX,NCV)
      CALL ABORTJ(7,XEROX,NK)
      CALL ABORTJ(8,XEROX,NSPV)
      CALL ABORTJ(9,XEROX,NCVW)
C
      BOTU =(EWE(NB)-EWE(NO))
C
      DELTF1(NSF) = WSMOTH
      DELTF2(NSF) = WSMOTH
C
      IF (DELTF1(NSF)-1.0) 1210,1220,1220
 1210 DELTF1(NSF) = DELTF1(NSF)*BOTU
      DELTF2(NSF) = DELTF2(NSF)*BOTU
 1220 CONTINUE
C
      WFF11(NSF) = WFLAP1(NSF)
      WFF21(NSF) = WFLAP2(NSF)
      WFF31(NSF) = WFLAP3(NSF)
C
      IF (WFF11(NSF)-1.01) 1230,1240,1240
 1230 WFF11(NSF) = WFF11(NSF)*BOTU
 1240 IF (WFF21(NSF)-1.01) 1250,1260,1260
 1250 WFF21(NSF) = WFF21(NSF)*BOTU
 1260 IF (WFF31(NSF)-1.01) 1270,1280,1280
 1270 WFF31(NSF) = WFF31(NSF)*BOTU
 1280 CONTINUE
C
      WFF11(NSF) =  WFF11(NSF) - DELTF1(NSF)/2.0
      WFF21(NSF) =  WFF21(NSF) - DELTF1(NSF)/2.0
      WFF31(NSF) =  WFF31(NSF) - DELTF1(NSF)/2.0
C
      WFF12(NSF) =  WFF11(NSF) + DELTF1(NSF)
      WFF22(NSF) =  WFF21(NSF) + DELTF1(NSF)
C
C
C  ** CALCULATE WING PANELS **
C
      IF (NSF-NWING) 1290,1290,1300
 1290 CONTINUE
      SYMF= 2.0
      SPAN = BOTU*2.0
      WINGD(NSF,1)=  Y(NB)*2.0
      GO TO 1310
 1300 CONTINUE
      SYMF= 1.0
      SPAN= BOTU
      WINGD(NSF,1)= SPAN
 1310 CONTINUE
C
      WINGD(NSF,2)=  C(NO)
      WINGD(NSF,3)=  C(NB)
```

```
      WINGD(NSF,4)=  E(NO)                                              A03 2080
      WINGD(NSF,5)=  E(NB)                                              A03 2090
C                                                                       A03 2100
      DSPAN= SPAN/FLOAT(NSPV)                                           A03 2110
C                                                                       A03 2120
      JN1(NSF) =  J1                                                    A03 2130
      JN2(NSF) =  J1 +NSPV -1                                           A03 2140
      KN2(NSF) =  NCV                                                   A03 2150
      J2 = JN2(NSF)                                                     A03 2160
      J3 = J2 +1                                                        A03 2170
C                                                                       A03 2180
      CALL ABORTJ(Z,XEROX,J3)                                           A03 2190
C                                                                       A03 2200
      SYMGF(NSF)= SYMF                                                  A03 2210
C                                                                       A03 2220
C                                                                       A03 2230
C                                                                       A03 2240
C  ** VORTEX LATTICE GEOMETRY **                                        A03 2250
C                                                                       A03 2260
      DO 1390 J=J1,J3                                                   A03 2270
C                                                                       A03 2280
      WS= -BOTU*(SYMF-1.0) + DSPAN*FLOAT(J-J1)                          A03 2290
      WAA= ABS(WS)                                                      A03 2300
      WA = WAA + EWE(NC)                                                A03 2310
C                                                                       A03 2320
      CALL CORDF(WA,YA,XLE,XTF,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 2330
C                                                                       A03 2340
      SIGN=1.0                                                          A03 2350
      TEST= 0.0001-WAA                                                  A03 2360
      IF (TEST) 1320,1330,1330                                          A03 2370
 1320 SIGN= WS/WAA                                                      A03 2380
 1330 YB= YA*SIGN                                                       A03 2390
      IF (NCDIS-1) 1350,1340,1340                                       A03 2400
 1340 CW= CW - CF                                                       A03 2410
 1350 CONTINUE                                                          A03 2420
C                                                                       A03 2430
      DO 1360 K=1,NCV                                                   A03 2440
C                                                                       A03 2450
      XKM= FLOAT(K-1)                                                   A03 2460
C                                                                       A03 2470
      EY(J,K)= WS                                                       A03 2480
      EC(J,K)= CW*DCORD                                                 A03 2490
      EW(J,K)= WA                                                       A03 2500
C                                                                       A03 2510
      EV(J,K,1)= XLE + CW*DCORD*(0.25+XKM)                              A03 2520
      EV(J,K,2)= YB                                                     A03 2530
      EV(J,K,3)= ZLE                                                    A03 2540
C                                                                       A03 2550
      EN(J,K,1)= XLE + CW*DCORD*(COLOCP + XKM)                          A03 2560
      EN(J,K,2)= YB                                                     A03 2570
      EN(J,K,3)= ZLE                                                    A03 2580
C                                                                       A03 2590
 1360 CONTINUE                                                          A03 2600
C                                                                       A03 2610
C                                                                       A03 2620
      IF (NCDIS-1) 1390,1370,1380                                       A03 2630
 1370 CONTINUE                                                          A03 2640
C                                                                       A03 2650
      K= NCV                                                            A03 2660
      EC(J,K)  = CF                                                     A03 2670
      EV(J,K,1)= XTE - CF*0.75                                          A03 2680
      EN(J,K,1)= XTE - CF*(1.0 - COLOCP)                                A03 2690
      GO TO 1390                                                        A03 2700
C                                                                       A03 2710
 1380 CONTINUE                                                          A03 2720
      K= NCV                                                            A03 2730
      EC(J,K)= CTAB                                                     A03 2740
      EV(J,K,1)= XTE - CTAB*0.75                                        A03 2750
      EN(J,K,1)= XTE - CTAB*( 1.0 - COLOCP )                            A03 2760
      K= K -1                                                           A03 2770
      EC(J,K)  = CF - CTAB                                              A03 2780
      EV(J,K,1)= XTE - CTAB - EC(J,K)*0.75                              A03 2790
      EN(J,K,1)= XTE - CTAB - EC(J,K)*(1.0 - COLOCP)                    A03 2800
C                                                                       A03 2810
C                                                                       A03 2820
 1390 CONTINUE                                                          A03 2830
C                                                                       A03 2840
C                                                                       A03 2850
      DO 1410 J=J1,J3                                                   A03 2860
C                                                                       A03 2870
      WA= EW(J,1)                                                       A03 2880
C                                                                       A03 2890
      CALL CORDF(WA,YA,XLE,XTF,ZLF,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2) A03 2900
C                                                                       A03 2910
      DO 1400 K=1,NCV                                                   A03 2920
C                                                                       A03 2930
      XF1= EV(J,K,1)                                                    A03 2940
      ZF1= EV(J,K,3)                                                    A03 2950
C                                                                       A03 2960
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW,  XF1,ZF1)               A03 2970
C                                                                       A03 2980
      EV(J,K,3) = ZF1                                                   A03 2990
C                                                                       A03 3000
      XF1= EN(J,K,1)                                                    A03 3010
      ZF1= EN(J,K,3)                                                    A03 3020
C                                                                       A03 3030
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW,  XF1,ZF1)               A03 3040
C                                                                       A03 3050
      EN(J,K,3) = ZF1                                                   A03 3060
C                                                                       A03 3070
 1400 CONTINUE                                                          A03 3080
 1410 CONTINUE                                                          A03 3090
C                                                                       A03 3100
C                                                                       A03 3110
C                                                                       A03 3120
      DO 1430 J=J1,J2                                                   A03 3130
```

```
      J3= J+1
C
      DO 1420 K=1,NCV
C
      EY(J,K)=  FY(J3,K)-EY(J,K)
      ES(J,K)= 0.5*EY(J,K)*( EC(J,K) +EC(J3,K) )
C
      EN(J,K,1)= 0.5*( EN(J,K,1) + EN(J3,K,1) )
      EN(J,K,2)= 0.5*( EN(J,K,2) + EN(J3,K,2) )
      EN(J,K,3)= 0.5*( EN(J,K,3) + EN(J3,K,3) )
C
 1420 CONTINUE
 1430 CONTINUE
C
C
C  ** CALCULATE UNIT VECTORS **
C
      DO 1490 J=J1,J2
      J3= J+1
C
      DO 1480 K=1,NCV
C
      SUM1= 0.0
      SUM2= 0.0
      DO 1440 L=1,3
      M= L +3
      EV(J,K,M)= EV(J3,K,L) - EV(J,K,L)
      EN(J,K,M)= EN(J,K,L) - 0.5*( EV(J3,K,L)+EV(J,K,L) )
      SUM1=  SUM1 + EV(J,K,M)**2
 1440 SUM2=  SUM2 + EN(J,K,M)**2
C
      SUM1 = SQRT(SUM1)
      SUM2 = SQRT(SUM2)
C
      DO 1450 L=1,3
      M= L +3
      EV(J,K,M)=  EV(J,K,M)/SUM1
      EN(J,K,1)= XTE - CTAB - EC(J,K)*(1.0 - COLOCP)
C
C
 1390 CONTINUE
C
C
      DO 1410 J=J1,J3
C
      WA= EW(J,1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      DO 1400 K=1,NCV
C
      XF1= EV(J,K,1)
      ZF1= EV(J,K,3)
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW,  XF1,ZF1)
C
      EV(J,K,3) = ZF1
C
      XF1= EN(J,K,1)
      ZF1= EN(J,K,3)
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW,  XF1,ZF1)
C
      EN(J,K,3) = ZF1
C
 1400 CONTINUE
 1410 CONTINUE
C
C
C
      DO 1430 J=J1,J2
      J3= J+1
C
      DO 1420 K=1,NCV
C
      EY(J,K)=  EY(J3,K)-EY(J,K)
      ES(J,K)= 0.5*EY(J,K)*( EC(J,K) +EC(J3,K) )
C
      EN(J,K,1)= 0.5*( EN(J,K,1) + EN(J3,K,1) )
      EN(J,K,2)= 0.5*( EN(J,K,2) + EN(J3,K,2) )
      EN(J,K,3)= 0.5*( EN(J,K,3) + EN(J3,K,3) )
C
 1420 CONTINUE
 1430 CONTINUE
C
C
C  ** CALCULATE UNIT VECTORS **
C
      DO 1490 J=J1,J2
      J3= J+1
C
      DO 1480 K=1,NCV
C
      SUM1= 0.0
      SUM2= 0.0
      DO 1440 L=1,3
      M= L +3
      EV(J,K,M)= EV(J3,K,L) - EV(J,K,L)
      EN(J,K,M)= EN(J,K,L) - 0.5*( EV(J3,K,L)+EV(J,K,L) )
      SUM1=  SUM1 + EV(J,K,M)**2
 1440 SUM2=  SUM2 + EN(J,K,M)**2
C
      SUM1 = SQRT(SUM1)
      SUM2 = SQRT(SUM2)
C
      DO 1450 L=1,3
```

```
      M= L +3
      EV(J,K,M)=  EV(J,K,M)/SUM1
      COS1(L)= -EN(J,K,M)/SUM2
 1450 COS2(L)= -EV(J,K,M)
C
      CALL CROSP(COS1,CCS2,COS3)
C
      SUM2= 0.0
      DO 1460 L=1,3
 1460 SUM2= SUM2 + COS3(L)**2
C
      SUM2= SQRT(SUM2)
C
      DO 1470 L=1,3
      M= L+3
 1470 EN(J,K,M)= COS3(L)/SUM2
C
 1480 CONTINUE
 1490 CONTINUE
C
C
C  ** CALCULATE WING CONSTANTS **
C
C     WINGD(NSURF, 1)  = B, SPAN
C     WINGD(NSURF, 2)  = CR, ROOT CHORD
C     WINGD(NSURF, 3)  = CT, TIP CHORD
C     WINGD(NSURF, 4)  = ER, GEOMETRIC TWIST AT ROOT STATION
C     WINGD(NSURF, 5)  = ET, GEOMETRIC TWIST AT TIP STATTION
C     WINGD(NSURF, 6)  = S, AREA
C     WINGD(NSURF, 7)  = AR, ASPECT RATIO
C     WINGD(NSURF, 8)  = CM, MEAN CHORD
C     WINGD(NSURF, 9)  = MGC, MEAN GEOMETRIC CHORD
C     WINGD(NSURF,10)  = YMGC, SPAN LOCATION OF 1/4 MGC
C     WINGD(NSURF,11)  = XMGC, HORIZONTAL MOMENT ARM TO 1/4 MGC
C     WINGD(NSURF,12)  = ZMGC, VERTICAL MOMENT ARM TO 1/4 MGC
C     WINGD(NSURF,13)  = DIHEDRAL ANGLE OF 1/4 MGC
C     WINGD(NSURF,14)  = SWEEP ANGLE OF 1/4 MGC
C
C
      JX  =  100
      DJX =  FLOAT(JX)
      DSPAN= SPAN/DJX
      ZERO = DSPAN/2.0
C
      SUMA = 0.0
      SUMY = 0.0
      SUMC = 0.0
      SUMX = 0.0
      SUMY = 0.0
      SUMZ = 0.0
C
      DO 1530 J=1,JX
C
      WS= -BOTU*(SYMF-1.0) + DSPAN*FLOAT(J-1) + ZERO
      WA= ABS(WS) + EWE(NO)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      DA= CW*DSPAN
      IF(SYMF-1.0)1520,1520,1500
 1500 DA= DA/SQRT( 1.0 + TAND**2 )
 1520 CONTINUE
C
      DAC = DA*CW
      XF1 = XLE + CW/4.0
      ZF1 = ZLE
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
      SUMA = SUMA + DA
      SUMC = SUMC + DAC
      SUMX = SUMX + DA*XF1
      SUMY = SUMY + DA*YA
      SUMZ = SUMZ + DA*ZF1
C
 1530 CONTINUE
C
C
      WINGD(NSF, 6) = SUMA
      WINGD(NSF, 7) = (WINGD(NSF,1)**2)/WINGD(NSF,6)
      WINGD(NSF, 8) = WINGD(NSF,6)/WINGD(NSF,1)
      WINGD(NSF, 9) = SUMC/SUMA
      WINGD(NSF,10) = SUMY/SUMA
      WINGD(NSF,11) = SUMX/SUMA
      WINGD(NSF,12) = SUMZ/SUMA
C
      WA= 0.5*( EWE(NO) + EWE(NB) )
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      WINGD(NSF,13) = RAD*ATAN( TAND )
      WINGD(NSF,14) = RAD*ATAN( TANS )
C
C
C
C  ** WING GEOMETRY **
C
      CALL PAGE
      WRITE (KOUT,1010)NSF,(WINGD(NSF,I),I=1,12),WFLAP1(NSF),WFLAP2(NSF)
     1,WFLAP3(NSF),FLAPDJ(NSF),TABDJ(NSF),(AILDJ(I,NSF),I=1,2),(WINGD(NS
     2F,I),I=13,14),NSPV,NCV,NCDIS,XCG,YCG,ZCG,REFS,REFC,REFB
C
      LIN = LIN + 19
      WRITE (KOUT,1030)
      LIN= LIN+3
C
```

```
C
      DSPAN= SPAN/20.0
      DO 1580 J=1,21
C
      WS= -BOTU*(SYMF-1.0) + DSPAN*FLOAT(J-1)
      WAA =  ABS(WS)
      WA = WAA + EWE(NO)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      SIGN = 1.0
      TEST= 0.0001 - WAA
      IF (TEST) 1540,1550,1550
 1540 SIGN=  WS/WAA
 1550 YB= YA*SIGN
      DIHE = SIGN*RAD*ATAN(TAND)
      BETA = SIGN*RAD*ATAN(TANS)
      XCO4= XLE + CW/4.0
C
      IF (LINX-LIN) 1560,1570,1570
 1560 CALL PAGE
      WRITE (KOUT,1030)
      LIN = LIN +2
 1570 WRITE (KOUT,1040)WS,YB,ZLE,XLE,XCO4,XTE,EPS,DIHE,BETA,CW,CF,CTAB
      LIN= LIN +1
 1580 CONTINUE
C
C
C
C  ** AIRFOIL SECTION **
C
      WRITE (KOUT,1000)
      LIN= LIN +7 +3
      IF (LINX-LIN) 1590,1600,1600
 1590 CALL PAGE
      LIN= LIN +7
 1600 WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)
      LIN= LIN +1
C
      DO 1650 J=NO,NB
      IF (LINX-LIN) 1610,1620,1620
 1610 CALL PAGE
      WRITE (KOUT,1050)(XOC(I,NSF),I=1,10)
      LIN= LIN +7
 1620 CONTINUE
C
      DO 1630 K=1,10
 1630 DUMYF(K)=0.0
      K=0
      DO 1640 KN=1,NK
      K= K+1
 1640 DUMYF(K)= ZOC(KN,J)
      WRITE (KOUT,1060)X(J),Y(J),(DUMYF(I),I=1,10)
      LIN= LIN +1
 1650 CONTINUE
C
C
      LIN= LIN +3
      IF (LINX-LIN) 1660,1670,1670
 1660 CALL PAGE
      LIN= LIN+3
 1670 WRITE (KOUT,1000)
C
C
C
C *** DEBUG OUTPUT ***
C
      J16 = JN1(NSF)
      J26 = JN2(NSF)
 1680 J1 = JN1(NSF)
      J2 = JN2(NSF)
      K2 = KN2(NSF)
      IF (IFLG(20)-1) 1880,1690,1690
 1690 CONTINUE
C
      J3 = J2 +1
C
      LIN= LIN +2
      IF (LINX-LIN) 1700,1710,1710
 1700 CALL PAGE
      LIN= LIN +2
 1710 WRITE (KOUT,1070)
C
      DO 1770 K=1,K2
      LIN= LIN +1
      DO 1760 J=J1,J2
      IF (JSINGP(NSF).EQ.J) GO TO 1760
      LIN= LIN +1
      IF (LINX-LIN) 1720,1730,1730
 1720 CALL PAGE
      WRITE (KOUT,1070)
      LIN= LIN +2  +1
 1730 JP1= J +1
      WA= EWE(NO)
      TEST= ABS(EW(J,K)-EW(JP1,K)) -0.001
      IF (TEST) 1750,1750,1740
 1740 WA= 0.5*( EW(J,K) + EW(JP1,K) )
 1750 WB= WA - EWE(NO)
      WRITE (KOUT,1080)J,K,(EN(J,K,I),I=2,3),WB,WA,EY(J,K),EC(J,K),ES(J,
     *K)
 1760 CONTINUE
 1770 WRITE (KOUT,1020)
C
      LIN= LIN + 3
      IF (LINX-LIN) 1780,1790,1790
 1780 CALL PAGE
```

```
      LIN= LIN + 3
 1790 WRITE (KOUT,1000)
      LIN= LIN +2
      IF (LINX-LIN) 1800,1810,1810
 1800 CALL PAGE
      LIN= LIN +2
 1810 WRITE (KOUT,1090)
C
      DO 1850 K=1,K2
      LIN= LIN +1
      DO 1840 J=J1,J2
      IF (JSINGP(NSF).EQ.J) GO TO 1840
      LIN= LIN +1
      IF (LINX-LIN) 1820,1830,1830
 1820 CALL PAGE
      WRITE (KOUT,1090)
      LIN= LIN +2
 1830 CONTINUE
      WRITE (KOUT,1100)J,K,(EV(J,K,I),I=1,6),(EN(J,K,I),I=1,6)
 1840 CONTINUE
 1850 WRITE (KOUT,1020)
C
C
      LIN= LIN +3
      IF (LINX-LIN) 1860,1870,1870
 1860 CALL PAGE
      LIN= LIN +3
 1870 WRITE (KOUT,1000)
C
C
C
C    * WRITE ON CALCOMPLOT TAPE *
C
 1880 IF (IFLG(19)-1) 2020,1890,1890
 1890 CONTINUE
C
      KFILE =  KFILE +1
      KREC = 1
      KWORD =  6
C
      J1 = J16
      J2 = J26
      J3 = J26 +1
      REFL = WINGD(1,1)/2.0
      XZER =  WINGD(1,11)
      YZER =  0.0
      ZZER =  WINGD(1,12)
C
C    * RECORD 1 - FILE NSURF *
C
      DO 1900 J=J1,J3
C
      WA =  EW(J,1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      YLE= EV(J,1,2)
      YTE= YLE
      ZTE= ZLE
      XLC= XLE
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLC,CW, XLE,ZLE)
C
      SHE= YLE
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XLE,YLE,ZLE, COS3)
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XTE,ZTE)
C
      SHE= YTE
      XLC= XTE
      CALL FLAPI(NSF,WA,SHE,XLC,CF,CTAB,TAND,  XTE,YTE,ZTE, COS3)
C
      CALL ISOMET(XLE,YLE,ZLE,  REFL,XZER,YZER,ZZER)
      CALL ISOMET(XTE,YTE,ZTE,  REFL,XZER,YZER,ZZER)
C
 1900 WRITE (KT2)KREC,KWORD,XLE,YLE,ZLE,XTE,YTE,ZTE
C
C
C    * RECORD 2 - FILE NSURF *
C
      KREC= KREC +1
      KWORD= 3
      ITET= 1
C
      DO 1960 J=J1,J3
C
      WA = EW(J,1)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      ITET = -ITET
      KFW = (ITET + 1)/2
      KFB = (1 - ITET)/2
C
      DO 1950 KX=1,K2
C
      K = KX*KFW + (K2+1-KX)*KFB
      XF1 = EV(J,K,1) - 0.25*EC(J,K)
      YF1 = EV(J,K,2)
      ZF1 = ZLE
C
      XF2 = XF1 + EC(J,K)
      YF2 = YF1
      ZF2 = ZLE
C
      IF (ITET) 1910,1910,1930
```

```
 1910 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)
C
      SHE= YF2
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XF2,YF2,ZF2, COS3)
C
      CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)
C
      WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2
C
      IF (K2-KX) 1920,1920,1950
 1920 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
      SHE= YF1
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XF1,YF1,ZF1, COS3)
C
      CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)
C
      WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1
      GO TO 1950
C
 1930 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
      SHE= YF1
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XF1,YF1,ZF1, COS3)
C
      CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)
C
      WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1
C
      IF (K2-KX) 1940,1940,1950
 1940 CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF2,ZF2)
C
      SHE= YF2
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XF2,YF2,ZF2, COS3)
C
      CALL ISOMET(XF2,YF2,ZF2, REFL,XZER,YZER,ZZER)
C
      WRITE (KT2)KREC,KWORD,XF2,YF2,ZF2
C
 1950 CONTINUE
 1960 CONTINUE
C
C
C   * RECORD 3 - FILE NSURF *
C
      KREC= KREC +1
      KWORD= 3
      ITET = -1
C
      DO 2010 K=2,K2
C
      DO 2000 J=J1,J3
C
      IF (ITET) 1970,1970,1980
 1970 JR= J
      GO TO 1990
 1980 JR= J1+J3 -J
 1990 CONTINUE
C
      WA = EW(JR,K)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
C
      XF1 = EV(JR,K,1) - 0.25*EC(JR,K)
      YF1 = EV(JR,K,2)
      ZF1 = ZLE
C
      CALL CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW, XF1,ZF1)
C
      SHE = YF1
      CALL FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,  XF1,YF1,ZF1, COS3)
C
      CALL ISOMET(XF1,YF1,ZF1, REFL,XZER,YZER,ZZER)
C
 2000 WRITE (KT2)KREC,KWORD,XF1,YF1,ZF1
C
C
      ITET= -ITET
C
 2010 CONTINUE
C
C
      END FILE KT2
      LIN= LIN +2
      WRITE (KOUT,1130)KFILE
C
C
 2020 CONTINUE
C
C
C *** COMPUTE IMAGE VERTICAL SURFACES ***
C
      IF (NREPET.EQ.0) GO TO 2060
      NREPET= 0
      IMAGEF(NSF)= 2*IMAGEF(NSF)
      J1 = JN1(NSF)
      J2 = JN2(NSF)
      J3 = J2 +1
      JI= J3
      JSINGP(NSF)= J3
      SYMGF(NSF) = 2.0
      WINGD(NSF,6) = WINGD(NSF,6)*2.0
      WINGD(NSF,10)= 0.0
      DO 2050 J=J1,J3
      JI= JI +1
      DO 2040 K=1,K2
```

```
      DO 2030 L=1,6                                                     A03 8440
      EN(JI,K,L) = EN(J,K,L)                                            A03 8450
 2030 EV(JI,K,L) = EV(J,K,L)                                            A03 8460
      FY(JI,K) = FY(J,K)                                                A03 8470
      ES(JI,K) = ES(J,K)                                                A03 8480
      EW(JI,K)= FW(J,K)                                                 A03 8490
      EC(JI,K)= EC(J,K)                                                 A03 8500
      EN(J,K,2) = -EN(J,K,2)                                            A03 8510
      EV(J,K,2) = -EV(J,K,2)                                            A03 8520
 2040 CONTINUE                                                          A03 8530
 2050 CONTINUE                                                          A03 8540
      JN2(NSF)= JI -1                                                   A03 8550
      GO TO 1680                                                        A03 8560
C                                                                       A03 8570
C                                                                       A03 8580
 2060 JI= JN2(NSF) +2                                                   A03 8590
C                                                                       A03 8600
      RETURN                                                            A03 8610
C     XXXXXX                                                            A03 8620
C                                                                       A03 8630
      END                                                               A03 8640


▽ FOR A04,A04                                                           A04   10
C                                                                       A04   20
C                                                                       A04   30
      SUBROUTINE LIFTX(ALFA,ZHEIGT,SYMLF,NSURFL,NSURF2)                 A04   40
C                                                                       A04   50
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A04   60
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A04   70
C                                                                       A04   80
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA04   90
C                                                                       A04  100
      DOUBLE PRECISION SCALE,SUP,DETERM,AMAT(100,100),VMAT(100)         A04  110
      DIMENSION JNO(5)                                                  A04  120
      DIMENSION SYMLF(5), SUMSL(4)                                      A04  130
      DIMENSION P(3),B(3),D(3)                                          A04  140
      DIMENSION COS1(3),COS2(3),COS3(3)                                 A04  150
      DIMENSION PW(3),BW(3),DW(3)                                       A04  160
      DIMENSION SUML(2,5,3),SUMR(2,5,3),SUMP(2,5,3),FACN(5,3)           A04  170
      DIMENSION SUMLG(3),SUMPG(3),FACNG(3)                              A04  180
      DIMENSION ZUML(2,5,3),ZUMR(2,5,3),ZUMP(2,5,3)                     A04  190
      DIMENSION ZUMLG(3),ZUMPG(3),ZACNG(3),ZUMSL(4)                     A04  200
C                                                                       A04  210
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX   A04  220
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP          A04  230
     2 ,IFLG(20), EXECK(15)                                             A04  240
C                                                                       A04  250
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)       A04  260
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30) A04  270
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)            A04  280
     3 ,XOC(10,5), ZOC(10,30)                                           A04  290
      COMMON/DATA22/IMAGEF(5),JSINGP(5)                                 A04  300
C                                                                       A04  310
      COMMON/DATA03/FLAPDJ(5),TABDJ(5),AILDJ(2,5),DELTF1(5),DELTF2(5)   A04  320
     1 ,WFF11(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)                A04  330
     2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)                                 A04  340
C                                                                       A04  350
      COMMON/DATA04/ WINGO(5,16), JN1(5), JN2(5), KN2(5), SYMGF(5),NSURFA04  360
     1 ,EW(60,10), EY(60,10), EC(60,10), ES(60,10), EG(60,10)           A04  370
     2 ,EN(60,10,6), EV(60,10,6), VVINDX(60,10,3)                       A04  380
C                                                                       A04  390
      COMMON/DATA05/XCG,YCG,ZCG,REFS,REFC,REFB                          A04  400
C                                                                       A04  410
C                                                                       A04  420
 1000 FORMAT(1X)                                                        A04  430
 1010 FORMAT(1X,//,1X)                                                  A04  440
C                                                                       A04  450
 1020 FORMAT(34X,41HVORTEX LATTICE MATRIX DETAIL-SURFACE NO.=,I2,2H/(,I2A04  460
     1,1H,I2,1H),/,34X,51(1H*),//,1X)                                   A04  470
 1030 FORMAT( 1X,12H  J  K NP NG,                                       A04  480
     2 60H  VFS(MAT)  VIN(MAT)    P(X)       P(Y)       P(Z)      B(X)    , A04  490
     3 50H   B(Y)       B(Z)       D(X)       D(Y)       D(Z)    ,/,1X) A04  500
 1040 FORMAT(1X,4I3,11F10.4)                                            A04  510
C                                                                       A04  520
 1050 FORMAT(36X,37HLIFT DISTRIBUTION DETAIL-SURFACE NO.=,I2,2H/(,I2,   A04  530
     1,1H,I2,1H),/,36X,47(1H*),//,1X)                                   A04  540
 1060 FORMAT(3X,4HJ  K,5X,40HP(X)       P(Y)       P(Z)      AREA     , A04  550
     160HCPN         G(X)       G(Y)       G(Z)       VI(X)      VI(Y)     , A04  560
     215HVI(Z)      GAMA ,     /,1X)                                    A04  570
 1070 FORMAT( 1X, 2I3, 3F10.3, 2F10.4, 6F10.5, E10.4 )                  A04  580
C                                                                       A04  590
 1080 FORMAT(34X,41HSECTION AIRLOAD COEFFICIENTS-SURFACE NO.=,I2,2H/(,I2A04  600
     1,1H,I2,1H),/,34X,51(1H*),//,1X)                                   A04  610
 1090 FORMAT(3X,52HJ       Y*        Y         Z         W        SCN       SCX,A04  620
     1 6X,58HSCL         SCO     SMP C/4   SCLC/B      1XL        1YL       1ZL ,A04  630
     2 /,1X )                                                           A04  640
 1100 FORMAT(1X,I3,F8.4,3F9.3,6F9.4,3F9.4)                              A04  650
C                                                                       A04  660
 1110 FORMAT(///,34X,45HINTEGRATED AIRLOAD COEFFICIENTS-SURFACE NOS.=,I2A04  670
     1,2H -,I2,/,34X,51(1H*),///,        29H  E       ECN        ECX        ECY,A04  680
     2 54H        ECL        ECD       ECMP       ECMR       ECMY        EXA,   A04  690
     3 33H     FZA         ES        FMGC       EB,/, 1X)               A04  700
 1120 FORMAT(1X,I2,      8F9.4, 5F9.2 )                                 A04  710
C                                                                       A04  720
 1130 FORMAT(1X,/,49X,20H*** AIRLOAD SUMS ***,//,                       A04  730
     * 3H AC,8F9.4,5F9.2, /,3H CG,8F9.4,5F9.2,                          A04  740
     */4H AC ,8(F8.4,1H*),5(F8.2,1H*),/4H CG ,8(F8.4,1H*),5(F8.2,1H*),  A04  750
     1 //,37X,14H* DETERMINANT=,E10.4,9H * SCALE=,E10.4,2H *,//,1X)     A04  760
 1140 FORMAT(1X,I2,1X,8(F8.4,1H*),5(F8.2,1H*) )                         A04  770
C                                                                       A04  780
C                                                                       A04  790
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA04  800
C                                                                       A04  810
C                                                                       A04  820
```


ORIGINAL PAGE IS
OF POOR QUALITY

```
C
C   * INITIALIZE *
C
      ALFAR= ALFA/RAD
      TANA = TAN(ALFAR)
      COSA = 1.0/SQRT(1.0+TANA**2)
      SINA = TANA*COSA
      TANV= -TAN(0.5*ALFAR)
      TANVG= -TAN(1.5*ALFAR)
      UNIT = 0.25/PIE
      UNITG= -UNIT
C
C
      DO 1160 NSF=NSURF1,NSURF2
C
      NZERO= JN1(NSF)
      TEST= SYMLF(NSF)
      IF (TEST) 1150,1150,1160
 1150 NZERO= IMAGEF(NSF)/2 + NZERO
      IF(JSINGP(NSF).NE.0) NZERO= NZERO +1
 1160 JN0(NSF)= NZERO
C
C
C
C   * CALCULATE MATRICES VMAT(NV) $ AMAT(NG,NV) *
C
      NV = 0
C
C
      DO 1520 NSF=NSURF1,NSURF2
C
      K= NSF + 5
      J1    = JN1(NSF)
      J2    = JN2(NSF)
      K2    = KN2(NSF)
      NZERO = JN0(NSF)
      NSPV= IMAGEF(NSF)
      NCV   = IFLG(K)
      NM = 0
      N00= NSS0(NSF)
C
C
C
      DO 1480 KV=1,K2
      DO 1450 JV=NZERO,J2
      IF (JSINGP(NSF).EQ.JV) GO TO 1450
      NV= NV+1
C
      SYMGF2= SYMGF(NSF)-1.0
      SYMGF3=-SYMGF(NSF)+2.0
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= -SINA
C
      DO 1170 L=1,3
      LP3= L +3
      COS2(L)= EN(JV,KV,LP3)
 1170 P(L)= EN(JV,KV,L)
C
      JP1= JV +1
      WA = EWE(N00)
      TEST= ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001
      IF (TEST) 1190,1190,1180
 1180 WA = (EW(JV,KV) + EW(JP1,KV) )/2.0
 1190 CONTINUE
      SHE = EN(JV,KV,2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      P,COS2)
      CALL DOTP(COS1,COS2,VMATOP)
C
C
      VMAT(NV)= VMATOP
C
C
      DO 1200 L=1,3
 1200 COS1(L)= COS2(L)
C
C
C
      NG= 0
      DO 1440 NSR=NSURF1,NSURF2
C
      J0 = JN0(NSR)
      J3 = JN1(NSR)
      J4 = JN2(NSR)
      K4 = KN2(NSR)
C
      SYMGF2 = SYMGF(NSR) - 1.0
      SYMGF3 =-SYMGF(NSR) + 2.0
      SYMLOG = SYMLF(NSR)
C
      DO 1430 KG=1,K4
C
      NV = 0
C
C
      DO 1520 NSF=NSURF1,NSURF2
C
      K= NSF + 5
      J1    = JN1(NSF)
      J2    = JN2(NSF)
      K2    = KN2(NSF)
      NZERO = JN0(NSF)
      NSPV= IMAGEF(NSF)
```

```
      NCV  = IFLG(K)
      NM = 0
      N00= NS50(NSF)
C
C
C
      DO 1480 KV=1,K2
      DO 1450 JV=NZERO,J2
      IF (JSINGP(NSF).EQ.JV) GO TO 1450
      NV= NV+1
C
      SYMGF2= SYMGF(NSF)-1.0
      SYMGF3=-SYMGF(NSF)+2.0
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= -SINA
C
      DO 1170 L=1,3
      LP3= L +3
      COS2(L)= EN(JV,KV,LP3)
 1170 P(L)= EN(JV,KV,L)
C
      JP1= JV +1
      WA = EWE(N00)
      TEST= ABS( EW(JV,KV) - EW(JP1,KV) ) - 0.001
      IF (TEST) 1190,1190,1180
 1180 WA = (EW(JV,KV) + EW(JP1,KV) )/2.0
 1190 CONTINUE
      SHE = EN(JV,KV,2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      P,COS2)
      CALL DOTP(COS1,COS2,VMATDP)
C
C
      VMAT(NV)= VMATDP
C
C
      DO 1200 L=1,3
 1200 COS1(L)= COS2(L)
C
C
C
      NG= 0
      DO 1440 NSR=NSURF1,NSURF2
C
      J0 = JN0(NSR)
      J3 = JN1(NSR)
      J4 = JN2(NSR)
      K4 = KN2(NSR)
C
      SYMGF2 = SYMGF(NSR) - 1.0
      SYMGF3 =-SYMGF(NSR) + 2.0
      SYMLDG = SYMLF(NSR)
C
      DO 1430 KG=1,K4
      DO 1420 JG=J0,J4
      IF (JSINGP(NSR).EQ.JG) GO TO 1420
      NG= NG+1
C
      JP1 = JG+1
      WA= EW(JG,KG)
C
      DO 1210 L=1,3
      LP3= L+3
      B(L)= EV(JG,KG,L)
 1210 D(L)= EV(JP1,KG,L)
C
      SHE = B(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,      B,COS3)
C
      WA = EW(JP1,KG)
      SHE = D(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,      D,COS3)
C
      DO 1220 L=1,3
      PW(L) = P(L)
      BW(L) = B(L)
 1220 DW(L) = D(L)
C
      CALL VORTEX(P,B,D,TANV,UNIT,  VI,COS2)
      CALL DOTP(COS1,COS2,SUM1)
C
      SUM1= SUM1*VI
      SUM2 = 0.0
C
      IF (IFLG(17)-1) 1240,1230,1230
 1230 CONTINUE
C
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG, VI,COS2)
      CALL DOTP(COS1,COS2,SUM3)
C
      SUM1= SUM1 + SUM3*VI
C
 1240 CONTINUE
C
      ITEST= J3 -J0
      IF (ITEST) 1250,1300,1300
```

```
 1250 JH = J3 + J4 - JG
      IF(JSINGP(NSR).NE.0) JH= JG-J0+J3
      IF (JH-JG) 1260,1300,1300
 1260 CONTINUE
C
      JP1 = JH +1
      WA= EW(JH,KG)
C
      DO 1270 L=1,3
      LP3= L +3
      B(L)= EV(JH,KG,L)
 1270 D(L)= EV(JP1,KG,L)
C
      SHE = B(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,       B,COS3)
C
      WA = EW(JP1,KG)
      SHE = D(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSR,WA,SHE,XTE,CF,CTAB,TAND,       D,COS3)
C
      IF(JSINGP(NSR).LE.JH.OR.J0.LE.J3)
     * CALL VORTEX( P,B,D, TANV,UNIT, VI,COS2 )
      IF(JSINGP(NSR).GT.JH.AND.J0.GT.J3)
     * CALL VORTEX( P,D,B, TANV,UNIT, VI,COS2 )
      CALL DOTP(COS1,COS2,SUM2)
C
      SUM2= SUM2*VI
C
      IF (IFLG(17)-1) 1290,1280,1280
 1280 CONTINUE
C
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      IF(JSINGP(NSR).LE.JH.OR.J0.LE.J3)
     * CALL VORTEX( P,B,D, TANV,UNIT, VI,COS2 )
      IF(JSINGP(NSR).GT.JH.AND.J0.GT.J3)
     * CALL VORTEX( P,D,B, TANV,UNIT, VI,COS2 )
      CALL DOTP(COS1,COS2,SUM4)
C
      SUM2= SUM2 + SUM4*VI
C
 1290 CONTINUE
C
 1300 CONTINUE
C
C
      AMAT(NG,NV) = SUM1 + SUM2
C
C
      IF (EXECK(15)-1.0) 1310,1410,1410
 1310 IF (IFLG(20)-5) 1410,1320,1320
 1320 IF (NM-1) 1330,1330,1390
 1330 LIN= LIN +4
      NM= 10
      IF (LINX-LIN) 1340,1350,1350
 1340 CALL PAGE
      LIN= LIN +4
 1350 WRITE (KOUT,1020)NSF,NSURF1,NSURF2
 1360 LIN= LIN +2
      IF (LINX-LIN) 1370,1380,1380
 1370 CALL PAGE
      LIN= LIN +2
 1380 WRITE (KOUT,1030)
 1390 LIN= LIN +1
      IF (LINX-LIN) 1370,1400,1400
 1400 WRITE (KOUT,1040)JV,KV,NV,NG,VMAT(NV),AMAT(NG,NV),(PW(I),I=1,3),(B
     1W(I),I=1,3),(DW(I),I=1,3)
 1410 CONTINUE
C
C
 1420 CONTINUE
 1430 CONTINUE
 1440 CONTINUE
C
C
      CALL ABORTJ(4,SUM1,NG)
C
C
 1450 CONTINUE
C
      IF (EXECK(15)-1.0) 1460,1480,1480
 1460 IF (IFLG(20)-5) 1480,1470,1470
 1470 WRITE (KOUT,1000)
      LIN= LIN +1
 1480 CONTINUE
C
C
      LIN= LIN +3
      IF (LINX-LIN) 1490,1500,1500
 1490 CALL PAGE
      GO TO 1510
 1500 WRITE (KOUT,1010)
 1510 CONTINUE
C
 1520 CONTINUE
C
C
C
C
C    * SOLVE FOR GAMA *
C
```

```
      NM= 0
      SUP= 0.0
      DO 1540 J=1,NV
      DO 1530 K=1,NG
      NM= NM+1
 1530 SUP= SUP + DABS( AMAT(K,J) )
 1540 CONTINUE
C
      SCALE = FLOAT(NM)
      SCALE =  SUP/SCALE
C
      DO 1560 J=1,NV
      DO 1550 K=1,NG
 1550 AMAT(J,K)= AMAT(J,K)/SCALE
 1560 CONTINUE
C
C
      CALL DMATIN(AMAT,NV,DETERM)
C
C
      NG= 0
      DO 1640 NSR=NSURF1,NSURF2
C
      J0 = JNO(NSR)
      J3 = JN1(NSR)
      J4 = JN2(NSR)
      K4 = KN2(NSR)
C
      DO 1630 K=1,K4
      DO 1620 J=J0,J4
      IF (JSINGP(NSR).EQ.J) GO TO 1620
      NG=NG+1
C
      SUP= 0.0
      NV= 0
      DO 1590 NSF=NSURF1,NSURF2
C
      NZERO= JNO(NSF)
      J1 =   JN1(NSF)
      J2 =   JN2(NSF)
      K2 =   KN2(NSF)
C
      DO 1580 KV=1,K2
      DO 1570 JV=NZERO,J2
      IF (JSINGP(NSF).EQ.JV) GO TO 1570
      NV=NV+1
      SUP = SUP - VMAT(NV)*AMAT(NV,NG)
 1570 CONTINUE
 1580 CONTINUE
 1590 CONTINUE
C
      SUP = SUP/SCALE
      SUM = -SUP
C
      EG(J,K)= SUM/FKECK(1)
C
      ITEST= J3 - J0
      IF (ITEST) 1600,1620,1620
 1600 JH = J3 + J4 - J
      IF(JSINGP(NSR).NE.0) JH= J -J0 +J3
      IF (JH-J) 1610,1620,1620
 1610 EG(JH,K)= EG(J,K)
 1620 CONTINUE
 1630 CONTINUE
 1640 CONTINUE
C
C
C
C
C    * SOLVE FOR INDUCED VELOCITY MATRIX *
C
      DO 1800 NSF=NSURF1,NSURF2
C
      NZERO= JNO(NSF)
      J1 = JN1(NSF)
      J2 = JN2(NSF)
      K2 = KN2(NSF)
C
      DO 1790 K=1,K2
      DO 1780 J=NZERO,J2
      IF (JSINGP(NSF).EQ.J) GO TO 1780
C
      JP1= J +1
      WA = EW(J,K)
      SYMGF2= SYMGF(NSF) -1.0
      SYMGF3=-SYMGF(NSF) +2.0
      SYMLDG= SYMLF(NSF)
C
      DO 1650 L=1,3
      LP3= L +3
      SUMSL(L)= 0.0
      B(L)= EV(J,K,L)
 1650 D(L)= EV(JP1, K,L)
C
      SHE = B(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      B,COS3)
C
      WA = EW(JP1,KG)
      SHE = D(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      D,COS3)
C
      DO 1660 L=1,3
```

```
 1660 P(L)= 0.5*( B(L)+D(L) )
C
C
      DO 1740 NSR=NSURF1,NSURF2
C
      J0 = JN0(NSR)
      J3 = JN1(NSR)
      J4 = JN2(NSR)
      K4 = KN2(NSR)
      SYMGF2= SYMGF(NSR) -1.0
      SYMGF3=-SYMGF(NSR) +2.0
C
      DO 1730 KG=1,K4
      DO 1720 JG=J3,J4
      IF (JSINGP(NSR).EQ.JG) GO TO 1720
C
      JP1= JG +1
      WA = EW(JG,KG)
C
      DO 1670 L=1,3
      LP3= L +3
      B(L)= EV(JG,KG,L)
 1670 D(L)= EV(JP1,KG,L)
C
      SHE = B(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      B,COS3)
C
      WA = EW(JP1,KG)
      SHE = D(2)
C
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TANS,RATS,M1,M2)
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,      D,COS3)
C
C
      CALL VORTEX(P,B,D,TANV,UNIT,VI,COS2)
C
      DO 1680 L=1,3
 1680 SUMSL(L)= SUMSL(L) - EG(JG,KG)*VI*COS2(L)
C
      IF (IFLG(17)-1) 1710,1690,1690
 1690 CONTINUE
C
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG,VI,COS2)
C
      DO 1700 L=1,3
 1700 SUMSL(L)=  SUMSL(L) - EG(JG,KG)*VI*COS2(L)
 1710 CONTINUE
C
 1720 CONTINUE
 1730 CONTINUE
 1740 CONTINUE
C
      DO 1750 L=1,3
 1750 VVINDX(J,K,L)= SUMSL(L)*EXECK(1)
C
      ITEST= J1 - NZERO
      IF (ITEST) 1760,1780,1780
 1760 JH= J1 +J2  -J
      IF(JSINGP(NSF).NE.0) JH= J -NZERO +J1
      IF (JH-J) 1770,1780,1780
 1770 CONTINUE
C
      VVINDX(JH,K,1) = VVINDX(J,K,1)
      VVINDX(JH,K,2) =-VVINDX(J,K,2)
      VVINDX(JH,K,3) = VVINDX(J,K,3)
C
 1780 CONTINUE
 1790 CONTINUE
 1800 CONTINUE
C
C
C
C
C  ** LIFTING SURFACES AIRLOAD COEFFICIENTS **
C
      DO 1830 L=1,3
      ZUMLG(L) = 0.0
      ZUMPG(L) = 0.0
      ZACNG(L) = 0.0
      SUMLG(L) = 0.0
      SUMPG(L) = 0.0
      FACNG(L) = 0.0
      DO 1820 M=1,2
      DO 1810 N=1,5
      ZUML(M,N,L) = 0.0
      ZUMR(M,N,L) = 0.0
      ZUMP(M,N,L) = 0.0
      SUML(M,N,L) = 0.0
      SUMR(M,N,L) = 0.0
 1810 SUMP(M,N,L) = 0.0
 1820 CONTINUE
 1830 CONTINUE
C
      DO 1840 N=1,NSURF
      FACN(N,1) = 2.0/WINGD(N,6)
      FACN(N,2) = FACN(N,1)/WINGD(N,9)
 1840 FACN(N,3) = FACN(N,1)/WINGD(N,1)
      FACNG(1) = 2.0/REFS
      FACNG(2) = FACNG(1)/REFC
      FACNG(3) = FACNG(1)/REFB
C
```

```
C
C
      DO 2110 NSF=NSURF1,NSURF2
C
      NM = 0
      J1 = JN1(NSF)
      J2 = JN2(NSF)
      K2 = KN2(NSF)
      NOO = NSSO(NSF)
C
      SYMGF2 =  SYMGF(NSF) -1.0
      SYMGF3 = -SYMGF(NSF) +2.0
C
      DO 2100 J=J1,J2
      IF (JSINGP(NSF).EQ.J) GO TO 2100
C
      JP1= J +1
      W1 = EW(J,1)
      W2 = EW(JP1,1)
      IF(JSINGP(NSF).GT.J.AND.JNO(NSF).GT.J1) W1= W2
      IF(JSINGP(NSF).GT.J.AND.JNO(NSF).GT.J1) W2= EW(J,1)
      WA = EWF(NOD)
      WB = 2.0*( W1-WA )
      TEST= ABS(W1-W2) -0.1
      IF (TEST) 1860,1860,1850
 1850 WA = (W1+W2)/2.0
      WB = ABS( W1-W2 )
 1860 CONTINUE
C
      CALL CORDF(W1,Y1,XL1,XT1,ZL1,EP1,CW1,CF1,CB1,TAD1,TAS1,RATS,M1,M2)
      CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CW2,CF2,CB2,TAD2,TAS2,RATS,M1,M2)
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TASO, RATS,M1,M2)
C
      TANLE= (XL2-XL1)/0.0001
      TANDE= (ZL2-ZL1)/0.0001
      FOSLE= ABS(Y2-Y1)/0.0001
      IF(FOSLE.GT.0.0001) TANLE= TANLE/FOSLE
      IF(FOSLE.GT.0.0001) TAND  = TAND/FOSLE
      IF(TEST.LT.0.0) TANLE= 0.0
      IF(TEST.LT.0.0) TAND = 0.0
      FOSLE = SQRT(1.0 + TANLE**2)
      XHE  =  0.5*( XT1+XT2  -CF1-CF2 )
      XHEE =  0.5*( XT1+XT2  -CB1-CB2 )
      COSD =  1.0/SQRT( 1.0 + TAND**2 )
      SIND= 1.0
      IF(TAND.LT.0) SIND= -1.0
      IF(COSD.GT.0.00001) SIND= TAND*COSD
      CW   =  0.5*( CW1+CW2 )
      DO 1870 L=1,4
 1870 ZUMSL(L) = 0.0
C
C
      DO 2040 K=1,K2
C
      NM= NM +1
C
      COS1(1)= VV(NOX(J,K,1) + COSA
      COS1(2)= VV(NOX(J,K,2)
      COS1(3)= VV(NOX(J,K,3) - SINA
C
      DO 1880 L=1,3
      B(L)= EV(J,K,L)
 1880 D(L)= EV(JP1,K,L)
C
      SH1 = B(2)
      SH2 = D(2)
C
      CALL FLAPS(NSF,W1,SH1,XT1,CF1,CB1,TAD1,       B,COS3)
      CALL FLAPS(NSF,W2,SH2,XT2,CF2,CB2,TAD2,       D,COS3)
C
      SUMB = 0.0
      DO 1890 L=1,3
      P(L)= 0.5*( B(L) + D(L) )
      COS2(L)= D(L)-B(L)
      IF(JSINGP(NSF).GT.J.AND.JNO(NSF).GT.J1) COS2(L)= -COS2(L)
 1890 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 1900 L=1,3
 1900 COS2(L) = COS2(L)/SUMB
C
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= EG(J,K)*SUMB
C
C
      DO 1910 L=1,3
      SUMSL(L)=   SLIFT*COS3(L)
      ZUMSL(L) = ZUMSL(L) + SUMSL(L)
      SUMLG(L)= SUMLG(L) + SUMSL(L)
      SUML(1,NSF,L)= SUML(1,NSF,L) + SUMSL(L)
 1910 SUML(2,NSF,L)= SUML(1,NSF,L)
C
      X1 = P(1)   - WINGD(NSF,11)
      X2 = P(2)
      X3 = P(3)   - WINGD(NSF,12)
C
      SUMP(1,NSF,1)= SUMP(1,NSF,1) + ( X1*SUMSL(3) -X3*SUMSL(1) )
      SUMP(1,NSF,2)= SUMP(1,NSF,2) - ( X2*SUMSL(3) -X3*SUMSL(2) )
      SUMP(1,NSF,3)= SUMP(1,NSF,3) - ( X2*SUMSL(1) -X1*SUMSL(2) )
C
      X1 = P(1) - WINGD(1,11)
      X2 = P(2)
      X3 = P(3) - WINGD(1,12)
C
      SUMP(2,NSF,1)= SUMP(2,NSF,1) + ( X1*SUMSL(3) - X3*SUMSL(1) )
```

```
      SUMP(2,NSF,2)= SLMP(2,NSF,2) - ( X2*SUMSL(3) - X3*SUMSL(2) )
      SUMP(2,NSF,3)= SLMP(2,NSF,3) - ( X2*SUMSL(1) - X1*SUMSL(2) )
C
      X1 = P(1) - XCG
      X2 = P(2) - YCG
      X3 = P(3) - ZCG
C
      SUMPG(1)= SUMPG(1) + ( X1*SUMSL(3) - X3*SUMSL(1) )
      SUMPG(2)= SUMPG(2) - ( X2*SUMSL(3) - X3*SUMSL(2) )
      SUMPG(3)= SUMPG(3) - ( X2*SUMSL(1) - X1*SUMSL(2) )
C
      SUM8= 0.0
      DO 1920 L=1,3
 1920 SUMB= SUM8 + SUMSL(L)**2
      SUMSL(4)= SQRT(SUMB)
      DO 1930 L=1,3
 1930 SUMSL(L)= SUMSL(L)/SUMSL(4)
C
C
C
      IF (EXECK(15)-1.C) 1940,2030,2030
 1940 IF (IFLG(20)-2) 2030,1950,1950
 1950 IF (NM-1) 1960,1960,2010
 1960 LIN = LIN +4
      NM = 10
      IF (LINX-LIN) 1970,1980,1980
 1970 CALL PAGE
      LIN= LIN +4
 1980 WRITE (KOUT,1050)NSF,NSURF1,NSURF2
      LIN= LIN +2
      IF (LINX-LIN) 1990,2000,2000
 1990 CALL PAGE
      LIN= LIN +2
 2000 WRITE (KOUT,1060)
 2010 LIN= LIN +1
      IF (LINX-LIN) 1950,2020,2020
 2020 CPLIFT = -2.0*SLIFT/FS(J,K)
      WRITE (KOUT,1070)J,K,(P(I),I=1,3),ES(J,K),CPLIFT,(COS3(I),I=1,3),(
     1VVINDX(J,K,I),I=1,3),EG(J,K)
 2030 CONTINUE
C
C
 2040 CONTINUE
C
      P(1) = XLE
      P(3) = ZLE
C
      SCTS = ZUMSL(1)
      IF(SCTS.GT.0.0) SCTS= 0.0
      SNFC = ABS(FOSLE*SCTS)
      IF(ZUMSL(3).LT.0.0) SNFC= -SNFC
      ZUMSL(1)=  -SCTS
      ZUMSL(2)= SCTS*TANLE
      ZUMSL(3)= SNFC
C
      X1 = P(1) - WINGD(NSF,11)
      X2 = P(2)
      X3 = P(3) - WINGD(NSF,12)
C
      ZUMP(1,NSF,1)= ZLMP(1,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )
      ZUMP(1,NSF,2)= ZLMP(1,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )
      ZUMP(1,NSF,3)= ZLMP(1,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )
C
      X1 = P(1) - WINGD(1,11)
      X2 = P(2)
      X3 = P(3) - WINGD(1,12)
C
      ZUMP(2,NSF,1)= ZUMP(2,NSF,1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )
      ZUMP(2,NSF,2)= ZCMP(2,NSF,2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )
      ZUMP(2,NSF,3)= ZLMP(2,NSF,3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )
C
      X1 = P(1) - XCG
      X2 = P(2) - YCG
      X3 = P(3) - ZCG
C
      ZUMPG(1)= ZUMPG(1) + ( X1*ZUMSL(3) - X3*ZUMSL(1) )
      ZUMPG(2)= ZUMPG(2) - ( X2*ZUMSL(3) - X3*ZUMSL(2) )
      ZUMPG(3)= ZUMPG(3) - ( X2*ZUMSL(1) - X1*ZUMSL(2) )
C
      DO 2050 L=1,3
      ZUMLG(L) = ZUMLG(L) + ZUMSL(L)
      ZUML(1,NSF,L)= ZUML(1,NSF,L) + ZUMSL(L)
 2050 ZUML(2,NSF,L)= ZLML(1,NSF,L)
C
      IF (EXECK(15)-1.C) 2060,2100,2100
 2060 IF (IFLG(20)-2) 2100,2070,2070
 2070 LIN= LIN +2
      IF (LINX-LIN) 2080,2090,2090
 2080 CALL PAGE
      GO TO 2100
 2090 WRITE (KOUT,1000)
      WRITE (KOUT,1000)
 2100 CONTINUE
C
C
      SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COSA - SUML(1,NSF,3)*SINA )
      SUMR(1,NSF,2) = SUML(1,NSF,2)
      SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COSA - SUML(1,NSF,1)*SINA )
C
      SUMR(2,NSF,1) = SUMR(1,NSF,1)
      SUMR(2,NSF,2) = SUMR(1,NSF,2)
      SUMR(2,NSF,3) = SUMR(1,NSF,3)
C
      SUML(1,NSF,3)= -SUML(1,NSF,3)
      SUML(2,NSF,3)= -SUML(1,NSF,3)
C
```

```
      ZUMR(1,NSF,1) = ( ZUML(1,NSF,1)*COSA - ZUML(1,NSF,3)*SINA )
      ZUMR(1,NSF,2) =   ZUML(1,NSF,2)
      ZUMR(1,NSF,3) = (-ZUML(1,NSF,3)*COSA - ZUML(1,NSF,1)*SINA )
C
      ZUMR(2,NSF,1) = ZUMR(1,NSF,1)
      ZUMR(2,NSF,2) = ZUMR(1,NSF,2)
      ZUMR(2,NSF,3) = ZUMR(1,NSF,3)
C
      ZUML(1,NSF,3)= -ZUML(1,NSF,3)
      ZUML(2,NSF,3)= -ZUML(1,NSF,3)
C
 2110 CONTINUE
C
C
C
      DO 2130 N=NSURF1,NSURF2
C
      DO 2120 L=1,3
      ZUML(2,N,L) = ZUML(1,N,L)*FACN(1,1)
      ZUMR(2,N,L) = ZUMR(1,N,L)*FACN(1,1)
      ZUML(1,N,L) = ZUML(1,N,L)*FACN(N,1)
      ZUMR(1,N,L) = ZUMR(1,N,L)*FACN(N,1)
      SUML(2,N,L) = SUML(1,N,L)*FACN(1,1)
      SUMR(2,N,L) = SUMR(1,N,L)*FACN(1,1)
      SUML(1,N,L) = SUML(1,N,L)*FACN(N,1)
 2120 SUMR(1,N,L) = SUMR(1,N,L)*FACN(N,1)
C
      ZUMP(1,N,1) = ZUMP(1,N,1)*FACN(N,2)
      ZUMP(1,N,2) = ZUMP(1,N,2)*FACN(N,3)
      ZUMP(1,N,3) = ZUMP(1,N,3)*FACN(N,3)
      ZUMP(2,N,1) = ZUMP(2,N,1)*FACN(1,2)
      ZUMP(2,N,2) = ZUMP(2,N,2)*FACN(1,3)
      ZUMP(2,N,3) = ZUMP(2,N,3)*FACN(1,3)
C
      SUMP(1,N,1) = SUMP(1,N,1)*FACN(N,2)
      SUMP(1,N,2) = SUMP(1,N,2)*FACN(N,3)
      SUMP(1,N,3) = SUMP(1,N,3)*FACN(N,3)
      SUMP(2,N,1) = SUMP(2,N,1)*FACN(1,2)
      SUMP(2,N,2) = SUMP(2,N,2)*FACN(1,3)
 2130 SUMP(2,N,3) = SUMP(2,N,3)*FACN(1,3)
C
C
      DO 2150 N=2,NSURF2
      DO 2140 L=1,3
      ZUML(2,1,L) = ZUML(2,1,L) + ZUML(2,N,L)
      ZUMR(2,1,L) = ZUMR(2,1,L) + ZUMR(2,N,L)
      ZUMP(2,1,L) = ZUMP(2,1,L) + ZUMP(2,N,L)
      SUML(2,1,L) = SUML(2,1,L) + SUML(2,N,L)
      SUMR(2,1,L) = SUMR(2,1,L) + SUMR(2,N,L)
 2140 SUMP(2,1,L) = SUMP(2,1,L) + SUMP(2,N,L)
 2150 CONTINUE
C
      ZUML(1,NSF,L)= ZUML(1,NSF,L) + ZUMSL(L)
 2050 ZUML(2,NSF,L)= ZUML(1,NSF,L)
C
      IF (EXECK(15)-1.0) 2060,2100,2100
 2060 IF (IFLG(20)-2) 2100,2070,2070
 2070 LIN= LIN +2
      IF (LINX-LIN) 2080,2090,2090
 2080 CALL PAGE
      GO TO 2100
 2090 WRITE (KOUT,1000)
      WRITE (KOUT,1000)
 2100 CONTINUE
C
C
      SUMR(1,NSF,1) = ( SUML(1,NSF,1)*COSA - SUML(1,NSF,3)*SINA )
      SUMR(1,NSF,2) = SUML(1,NSF,2)
      SUMR(1,NSF,3) = (-SUML(1,NSF,3)*COSA - SUML(1,NSF,1)*SINA )
C
      SUMR(2,NSF,1) = SUMR(1,NSF,1)
      SUMR(2,NSF,2) = SUMR(1,NSF,2)
      SUMR(2,NSF,3) = SUMR(1,NSF,3)
C
      SUML(1,NSF,3)= -SUML(1,NSF,3)
      SUML(2,NSF,3)= -SUML(1,NSF,3)
C
      ZUMR(1,NSF,1) = ( ZUML(1,NSF,1)*COSA - ZUML(1,NSF,3)*SINA )
      ZUMR(1,NSF,2) =   ZUML(1,NSF,2)
      ZUMR(1,NSF,3) = (-ZUML(1,NSF,3)*COSA - ZUML(1,NSF,1)*SINA )
C
      ZUMR(2,NSF,1) = ZUMR(1,NSF,1)
      ZUMR(2,NSF,2) = ZUMR(1,NSF,2)
      ZUMR(2,NSF,3) = ZUMR(1,NSF,3)
C
      ZUML(1,NSF,3)= -ZUML(1,NSF,3)
      ZUML(2,NSF,3)= -ZUML(1,NSF,3)
C
 2110 CONTINUE
C
C
C
      DO 2130 N=NSURF1,NSURF2
C
      DO 2120 L=1,3
      ZUML(2,N,L) = ZUML(1,N,L)*FACN(1,1)
      ZUMR(2,N,L) = ZUMR(1,N,L)*FACN(1,1)
      ZUML(1,N,L) = ZUML(1,N,L)*FACN(N,1)
      ZUMR(1,N,L) = ZUMR(1,N,L)*FACN(N,1)
      SUML(2,N,L) = SUML(1,N,L)*FACN(1,1)
      SUMR(2,N,L) = SUMR(1,N,L)*FACN(1,1)
      SUML(1,N,L) = SUML(1,N,L)*FACN(N,1)
 2120 SUMR(1,N,L) = SUMR(1,N,L)*FACN(N,1)
C
      ZUMP(1,N,1) = ZUMP(1,N,1)*FACN(N,2)
      ZUMP(1,N,2) = ZUMP(1,N,2)*FACN(N,3)
```

```
      ZUMP(1,N,3) = ZUMP(1,N,3)*FACN(N,3)
      ZUMP(2,N,1) = ZUMP(2,N,1)*FACN(1,2)
      ZUMP(2,N,2) = ZUMP(2,N,2)*FACN(1,3)
      ZUMP(2,N,3) = ZUMP(2,N,3)*FACN(1,3)
C
      SUMP(1,N,1) = SUMP(1,N,1)*FACN(N,2)
      SUMP(1,N,2) = SUMP(1,N,2)*FACN(N,3)
      SUMP(1,N,3) = SUMP(1,N,3)*FACN(N,3)
      SUMP(2,N,1) = SUMP(2,N,1)*FACN(1,2)
      SUMP(2,N,2) = SUMP(2,N,2)*FACN(1,3)
 2130 SUMP(2,N,3) = SUMP(2,N,3)*FACN(1,3)
C
C
      DO 2150 N=2,NSURF2
      DO 2140 L=1,3
      ZUML(2,1,L) = ZUML(2,1,L) + ZUML(2,N,L)
      ZUMR(2,1,L) = ZUMR(2,1,L) + ZUMR(2,N,L)
      ZUMP(2,1,L) = ZUMP(2,1,L) + ZUMP(2,N,L)
      SUML(2,1,L) = SUML(2,1,L) + SUML(2,N,L)
      SUMR(2,1,L) = SUMR(2,1,L) + SUMR(2,N,L)
 2140 SUMP(2,1,L) = SUMP(2,1,L) + SUMP(2,N,L)
 2150 CONTINUE
C
      DO 2160 L=1,3
      ZUMLG(L)= ZUMLG(L)*FACNG(1)
 2160 SUMLG(L)= SUMLG(L)*FACNG(1)
      ZUMLG(3)= -ZUMLG(3)
      SUMLG(3)= -SUMLG(3)
C
      ZUMPG(1) = ZUMPG(1)*FACNG(2)
      ZUMPG(2) = ZUMPG(2)*FACNG(3)
      ZUMPG(3) = ZUMPG(3)*FACNG(3)
C
      SUMPG(1) = SUMPG(1)*FACNG(2)
      SUMPG(2) = SUMPG(2)*FACNG(3)
      SUMPG(3) = SUMPG(3)*FACNG(3)
C
      ZACNG(2) = ZUMLG(1)*COSA + ZUMLG(3)*SINA
      ZACNG(3) = ZUMLG(2)
      ZACNG(1) = ZUMLG(3)*COSA - ZUMLG(1)*SINA
C
      FACNG(2) = SUMLG(1)*COSA + SUMLG(3)*SINA
      FACNG(3) = SUMLG(2)
      FACNG(1) = SUMLG(3)*COSA - SUMLG(1)*SINA
C
C
C
C  ** LIFTING SURFACES AIRLOAD SECTION COEFFICIENTS **
C
      DO 2360 NSF=NSURF1,NSURF2
C
      NM = 0
      J1 = JN1(NSF)
      J2 = JN2(NSF)
      K2 = KN2(NSF)
      NZERO = JN0(NSF)
      N00 = NSS0(NSF)
C
      SYMGF2 =  SYMGF(NSF) -1.0
      SYMGF3 = -SYMGF(NSF) +2.0
      SPAN = WINGD(NSF,1)
C
      DO 2330 J=NZERO,J2
      IF (JSINGP(NSF).EQ.J) GO TO 2330
C
      JP1= J +1
      NM = NM +1
      W1 = EW(J,1)
      W2 = EW(JP1,1)
      WA = EWE(N00)
      WB = 2.0*( W1-WA )
      TEST = ABS( W1 - W2 ) - 0.001
      IF (TEST) 2180,2180,2170
 2170 WA = (W1+W2)/2.0
      WB = ABS( W1-W2 )
 2180 CONTINUE
      RW = WA
C
      CALL CORDF(W1,Y1,XL1,XT1,ZL1,EP1,CW1,CF1,CB1,TAD1,TAS1,RATS,M1,M2)
      CALL CORDF(W2,Y2,XL2,XT2,ZL2,EP2,CW2,CF2,CB2,TAD2,TAS2,RATS,M1,M2)
      CALL CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTAB,TAND,TASD, RATS,M1,M2)
C
      TANLE = (ELE(M2)-ELE(M1))/WB
      FOSLE = SQRT(1.0 + TANLE**2)
      XHE  =  0.5*( XT1+XT2  -CF1-CF2 )
      XHEE =  0.5*( XT1+XT2  -CB1-CB2 )
      COSD =  1.0/SQRT( 1.0 + TAND**2 )
      SIND= 1.0
      IF(TAND.LT.0) SIND= -1.0
      IF(COSD.GT.0.00001) SIND= TAND*COSD
      CW   =  0.5*( CW1+CW2 )
      AREA= WB*CW*( COSD*SYMGF2  + SIND*SYMGF3  )
      IF(AREA.LT.1.0E-6) AREA=WB*CW*( COSD*SYMGF3 + SIND*SYMGF2 )
      XC04 = 0.5*(XL1+XL2) + 0.25*CW
C
      SCN = 0.0
      SCX = 0.0
      SPM = 0.0
      SCL = 0.0
      SCD = 0.0
C
C
      DO 2250 K=1,K2
C
      COSI(1)= VVINDX(J,K,1) + COSA
      COSI(2)= VVINDX(J,K,2)
```

```
      COS1(3)= VVINDX(J,K,3) - SINA
C
      DO 2190 L=1,3
      LP3= L +3
      B(L)= EV(J,K,L)
 2190 D(L)= EV(JP1,K,L)
C
      SH1 = B(2)
C
      CALL FLAPS(NSF,W1,SH1,XT1,CF1,CB1,TAD1,       B,COS3)
      CALL FLAPS(NSF,W2,SH2,XT2,CF2,CB2,TAD2,       D,COS3)
C
      SUM8 = 0.0
      DO 2200 L=1,3
      P(L)= 0.5*( B(L) + D(L) )
      COS2(L)= D(L)-B(L)
 2200 SUM8= SUM8 + COS2(L)**2
      SUM8 = SQRT(SUM8)
      DO 2210 L=1,3
 2210 COS2(L)= COS2(L)/SUM8
C
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= EG(J,K)*SUM8
C
C
      DO 2220 L=1,3
 2220 SUMSL(L)=  SLIFT*COS3(L)
C
C
      DCN =  -SUMSL(3)*SYMGF2 + SUMSL(1)*SYMGF3
C
      SCN = SCN + DCN
      SCX = SCX + SUMSL(1)
      SPM = SPM - DCN*((P(1)-XC04)/CW)
C
C
      SUM8= 0.0
      DO 2230 L=1,3
 2230 SUM8= SUM8 + SUMSL(L)**2
      SUMSL(4)= SQRT(SUM8)
      DO 2240 L=1,3
 2240 SUMSL(L)= SUMSL(L)/SUMSL(4)
C
C
 2250 CONTINUE
C
C
      SCN= SCN*(2.0/AREA)
      SCX= SCX*(2.0/AREA)
      SPM= SPM*(2.0/AREA)
C
      SCL= SYMGF2*(SCN*COSA-SCX*SINA)+SYMGF3*(SCN)
      SCD= SYMGF2*(SCX*SINA+SCN*SINA)+SYMGF3*(SCX*COSA)
C
      SCLCOB= SCL*CW/SPAN
C
      RY = EN(J,1,2)
      RZ = EN(J,1,3)
C
C
      IF (NM-1) 2260,2260,2310
 2260 LIN= LIN +4
      IF (LINX-LIN) 2270,2280,2280
 2270 CALL PAGE
      LIN= LIN +4
 2280 WRITE (KOUT,1080)NSF,NSURF1,NSURF2
      LIN= LIN +2
      IF (LINX-LIN) 2290,2300,2300
 2290 CALL PAGE
      LIN= LIN +2
 2300 WRITE (KOUT,1090)
 2310 LIN= LIN+1
      IF (LINX-LIN) 2250,2320,2320
 2320 YOB= ( EN(J,1,2)*SYMGF2 +(EN(J2,1,3)-EN(J,1,3))*SYMGF3 )/SPAN
C
C
      WRITE (KOUT,1100)J,YOB,RY,RZ,RW,SCN,SCX,SCL,SCD,SPM,SCLCOB,(SUMSL(
     1I),I=1,3)
      LIN= LIN +1
C
C
 2330 CONTINUE
      LIN= LIN +2
      IF (LINX-LIN) 2340,2350,2350
 2340 CALL PAGE
      GO TO 2360
 2350 WRITE (KOUT,1000)
      WRITE (KOUT,1000)
 2360 CONTINUE
C
C
C
C  ** LIFTING SURFACES AIRLOAD SUMMARY **
C
      LIN = LIN + 12
C
      IF (LINX-LIN) 2370,2380,2380
 2370 CALL PAGE
      LIN = LIN + 12
 2380 WRITE (KOUT,1110)NSURF1,NSURF2
C
C
      DO 2410 N=1,NSURF2
C
```

```
      LIN = LIN + 2                                                     A0411430
      IF (LINX-LIN) 2390,2400,2400                                      A0411440
 2390 CALL PAGE                                                         A0411450
      LIN = LIN + 12                                                    A0411460
      WRITE (KOUT,1110)NSURF1,NSURF2                                    A0411470
 2400 CONTINUE                                                          A0411480
C                                                                       A0411490
      WRITE (KOUT,1120)N,SUML(1,N,3),SUML(1,N,1),SUML(1,N,2),SUMR(1,N,3)A0411500
     1,SUMR(1,N,1),(SUMP(1,N,I),I=1,3),WINGD(N,11),WINGD(N,12),WINGD(N,6A0411510
     2),WINGD(N,9),WINGD(N,1)                                           A0411520
C                                                                       A0411530
      WRITE (KOUT,1140)N,ZUML(1,N,3),ZUML(1,N,1),ZUML(1,N,2),ZUMR(1,N,3)A0411540
     1,ZUMR(1,N,1),(ZUMP(1,N,I),I=1,3),WINGD(N,11),WINGD(N,12),WINGD(N,6A0411550
     2),WINGD(N,9),WINGD(N,1)                                           A0411560
C                                                                       A0411570
 2410 CONTINUE                                                          A0411580
C                                                                       A0411590
      LIN = LIN + 11                                                    A0411600
      IF (LINX-LIN) 2420,2430,2430                                      A0411610
 2420 CALL PAGE                                                         A0411620
      LIN = LIN + 11                                                    A0411630
 2430 CONTINUE                                                          A0411640
C                                                                       A0411650
      WRITE (KOUT,1130)SUML(2,1,3),SUML(2,1,1),SUML(2,1,2),SUMR(2,1,3),SA0411660
     1UMR(2,1,1),(SUMP(2,1,I),I=1,3),WINGD(1,11),WINGD(1,12),WINGD(1,6),A0411670
     2WINGD(1,9),WINGD(1,1),SUMLG(3),(SUMLG(I),I=1,2),(FACNG(I),I=1,2),(A0411680
     3SUMPG(I),I=1,3),XCG,ZCG,REFS,REFC,REFB,ZUML(2,1,3),ZUML(2,1,1),ZUMA0411690
     4L(2,1,2),ZUMR(2,1,3),ZUMR(2,1,1),(ZUMP(2,1,I),I=1,3),WINGD(1,11),WA0411700
     5INGD(1,12),WINGD(1,6),WINGD(1,9),WINGD(1,1),ZUMLG(3),(ZUMLG(I),I=1A0411710
     6,2),(ZACNG(I),I=1,2),(ZUMPG(I),I=1,3),XCG,ZCG,REFS,REFC,REFB,DETERA0411720
     7M,SCALE                                                           A0411730
C                                                                       A0411740
C                                                                       A0411750
      RETURN                                                            A0411760
C                                                                       A0411770
      END                                                               A0411780


V FOR A05,A05                                                           A05   10
C                                                                       A05   20
C                                                                       A05   30
      SUBROUTINE ABORTJ(NOGO,TEST,ITEST)                                A05   40
C                                                                       A05   50
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *A05   60
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *A05   70
C                                                                       A05   80
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA05   90
C                                                                       A05  100
C                                                                       A05  110
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX   A05  120
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP         A05  130
     2 ,IFLG(20), EXECK(15)                                            A05  140
C                                                                       A05  150
      EQUIVALENCE (D,N)                                                 A05  160
C                                                                       A05  170
      DATA CMAK/0.90/                                                   A05  180
      DATA I5/5/,I10/10/,I100/100/,I60/60/,I25/30/                      A05  190
C                                                                       A05  200
C                                                                       A05  210
 1000 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  220
     1 23HNO.OF LIFTING SURFACES=,I2,17H EXCEEDS FIVE ***,/,3X,67(1H*) )A05  230
C                                                                       A05  240
 1010 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  250
     2 20HNO.OF SPAN ELEMENTS=,I2,16H EXCEEDS 60 *** ,    /,3X,63(1H*) )A05  260
C                                                                       A05  270
 1020 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  280
     3 21HNO.OF CHORD ELEMENTS=,I2,16H EXCEEDS TEN ***,   /,3X,65(1H*) )A05  290
C                                                                       A05  300
 1030 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  310
     4 29HNO.OF VORTEX MATRIX ELEMENTS=,I2,16H EXCEEDS 100 ***,/,3X,72(1A05  320
     *H*) )                                                             A05  330
C                                                                       A05  340
 1040 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  350
     5 9HMACH NO.=, F6.3, 17H EXCEEDS 0.90 ***,/, 3X, 57(1H*) )         A05  360
C                                                                       A05  370
 1050 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  380
     6 17HNO.SPAN STATIONS=,I2,15H EXCEEDS 25 ***,/,3X,59(1H*) )        A05  390
C                                                                       A05  400
 1060 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  410
     7 18HNO.CHORD STATIONS=,I2,15H EXCEEDS 10 ***,/,3X,60(1H*) )       A05  420
C                                                                       A05  430
 1070 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  440
     8 20HNO.OF SPAN ELEMENTS=,I2,18H NOT PERMITTED ***,/,3X,65(1H*) )  A05  450
C                                                                       A05  460
 1080 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  470
     9 26HNO.OF WING CHORD ELEMENTS=,I2,18H NOT PERMITTED ***,/,3X,71(1HA05  480
     **) )                                                              A05  490
C                                                                       A05  500
 1090 FORMAT(1X,//,3X,25H *** JOB ABORTED BECAUSE ,                     A05  510
     * 32HINPUT ERROR IN NSS FLAG, NSS(N)=I2,11H.LT.NSS(M)=I2,4H ***,   A05  520
     * /,4X,75(1H*))                                                    A05  530
C                                                                       A05  540
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXA05  550
C                                                                       A05  560
C                                                                       A05  570
C                                                                       A05  580
      GO TO (1100,1110,1120,1130,1140,1150,1160,1170,1180,1190), NOGO   A05  590
 1100 IF (I5.LT.ITEST) WRITE (KOUT,1000)ITEST                           A05  600
      IF(I5.LT.ITEST)    CALL EXIT                                      A05  610
      RETURN                                                            A05  620
 1110 IF (I60.LT.ITEST) WRITE (KOUT,1010)ITEST                          A05  630
      IF(I60.LT.ITEST)   CALL EXIT                                      A05  640
      RETURN                                                            A05  650
 1120 IF (I10.LT.ITEST) WRITE (KOUT,1020)ITEST                          A05  660
      IF(I10.LT.ITEST)   CALL EXIT                                      A05  670
```

```
      RETURN
 1130 IF (I100.LT.ITEST) WRITE (KOUT,1030)ITEST
      IF(I100.LT.ITEST)  CALL EXIT
      RETURN
 1140 IF (CMAK.LT.TEST) WRITE (KOUT,1040)TEST
      IF(CMAK.LT.TEST)   CALL EXIT
      RETURN
 1150 IF (I25.LT.ITEST) WRITE (KOUT,1050)ITEST
      IF(I25.LT.ITEST)   CALL EXIT
      RETURN
 1160 IF (I10.LT.ITEST) WRITE (KOUT,1060)ITEST
      IF(I10.LT.ITEST)   CALL EXIT
      RETURN
 1170 IF (ITEST.LT.0) WRITE (KOUT,1070)ITEST
      IF(ITEST.LT.0)       CALL EXIT
      RETURN
 1180 IF (ITEST.LT.0) WRITE (KOUT,1080)ITEST
      IF(ITEST.LT.0)       CALL EXIT
      RETURN
 1190 D= TEST
      IF (N.LE.ITEST) WRITE (KOUT,1090)N,ITEST
      IF(N.LE.ITEST) CALL EXIT
      RETURN
C
      END
```

```
V FOR A06,A06
C
C
      SUBROUTINE CORDF(WA,YA,XLE,XTE,ZLE,EPS,CW,CF,CTB,TAND,TANS,R,M1,M)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
C
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      M= -1
      NX= 30
      DO 1020 L=2,NX
      IF (M) 1000,1000,1020
 1000 TEST= WA - EWE(L)  -0.001
      IF (TEST) 1010,1010,1020
 1010 M=L
 1020 CONTINUE
C
      IF (M-2) 1030,1040,1040
 1030 M=2
 1040 M1= M-1
C
      RATS=(WA-EWE(M1))/(EWE(M)-EWE(M1))
C
      XLE = ELE(M1) + RATS*(  ELE(M)  - ELE(M1)   )
      XTE = ETE(M1) + RATS*(  ETE(M)  - ETE(M1)   )
      XHE = EHE(M1) + RATS*(  EHE(M)  - EHE(M1)   )
      XHEE= EHEE(M1)+ RATS*( EHEE(M)  -EHEE(M1)   )
      EPS = E(M1) + RATS*( E(M)-E(M1) )
      ZLE = Z(M1) + RATS*( Z(M)-Z(M1) )
      CW = XTE - XLE
      CF = XTE - XHE
      CTB= XTE - XHEE
      R   = RATS
C
      DY = Y(M)-Y(M1)
      DW = EWE(M)-EWE(M1)
      YA = Y(M1) + RATS*DY
      TAND = 100000.0
      TEST= ABS(DY) -0.001
C
      IF (TEST) 1060,1060,1050
 1050 TAND= (Z(M1)-Z(M))/DY
 1060 TANS= (X(M)+C(M)*(0.25-XOCR(M))-X(M1)-C(M1)*(0.25-XOCR(M1)))/DW
C
      RETURN
C     XXXXXX
C
      END
```

```
V FOR A07,A07
C
C
      SUBROUTINE CAMBER(NSF,NK,M1,M2,RATS,EPS,XLE,CW,  XF,ZF)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION ZOCY(10)
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
```

```
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C
      IF(CW.LE.1.0E-4) RETURN
      DO 1000 L=1,NK
 1000 ZOCY(L)= ZOC(L,M1) + RATS*(ZOC(L,M2)-ZOC(L,M1))
C
      XOCREF = XOCR(M1) + RATS*(XOCR(M2)-XOCR(M1))
      TANE = TAN(EPS/RAD)
      XOCT = (XF-XLE)/CW
C
      N2 = -1
      DO 1030 L=2,NK
      IF (N2) 1010,1010,1030
 1010 TEST= XOCT - XOC(L,NSF) - 0.001
      IF (TEST) 1020,1020,1030
 1020 N2=L
 1030 CONTINUE
      IF (N2-1) 1040,1040,1050
 1040 N2= 2
 1050 N1= N2-1
C
      RAT = (XOCT - XOC(N1,NSF))/(XOC(N2,NSF)-XOC(N1,NSF))
      DELZ= CW*( ZOCY(N1) + RAT*( ZOCY(N2)-ZOCY(N1) ) )
C
      ZF   = ZF + DELZ + TANE*( XF - XLE - CW*XOCREF )
C
      RETURN
C
      END


V FOR A08,A08
C
C
      SUBROUTINE FLAPS(NSF,WA,SHEK,XTE,CF,CTAB,TAND,  P,COSN)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      REAL NOAIL,NOGO
      DIMENSION P(3), COSN(3)
C
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LORAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
      COMMON/DATA02/ NWING, NFUS, NVTAIL, NSS(5), NSSO(5), NCS(5)
     1 ,X(30), Y(30), Z(30), E(30), C(30), XOCR(30), FLAPC(30),TABC(30)
     2 ,WSMOTH, EWE(30), ELE(30), ETE(30), EHE(30), EHEE(30)
     3 ,XOC(10,5), ZOC(10,30)
C
      COMMON/DATA03/FLAPDJ(5),TABDJ(5),AILDJ(2,5),DELTF1(5),DELTF2(5)
     1 ,WFF11(5), WFF12(5), WFF21(5), WFF22(5), WFF31(5)
     2 ,WFLAP1(5), WFLAP2(5), WFLAP3(5)
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      N= NSF
      N10= NSF +10
      NOFLAP = IFLG(N10)
      IF(NOFLAP.LT.1) NOFLAP= 1
      NOTAB  = NOFLAP - 1
C
C
      IF (NOFLAP) 1310,1310,1000
 1000 XFLAP = P(1) - ( XTE - CF )
      XTAB  = P(1) - ( XTE - CTAB )
      IF (XFLAP) 1310,1310,1010
 1010 CONTINUE
C
C
      COSD = 1.0/SQRT(1.0+TAND**2)
      SIND = TAND*COSD
C
      COSX = COSN(1)
      COSY = COSN(2)*COSD - COSN(3)*SIND
      COSZ = COSN(3)*COSD + COSN(2)*SIND
C
      FLAPD = FLAPDJ(N)
      TABD  = TABDJ(N)
      AILD  = AILDJ(1,N)
      SIGN = 1.0
C
      IF (SHEK) 1020,1030,1030
 1020 SIGN = -1.0
      AILD = AILDJ(2,N)
 1030 CONTINUE
      NOAIL = ABS(AILD) - 0.1
C
C
      DFLAP= 0.0
```

```
      DAILD= 0.0
      DTAB = 0.0
C
      NO = NSSO(N)
      YA = WA - EWE(NO)
      WFF32 = WFF31(N) + WFF22(N)-WFF21(N)
C
      TST11 = YA - WFF11(N)
      TST12 = YA - WFF12(N)
      TST21 = YA - WFF21(N)
      TST22 = YA - WFF22(N)
      TST31 = YA - WFF31(N)
      TST32 = YA - WFF32
C
C
      IF (NOFLAP) 1120,1120,1040
 1040 IF (WFLAP1(N)) 1080,1080,1050
 1050 IF (TST11) 1120,1120,1060
 1060 IF (TST12) 1070,1080,1080
 1070 SMF =   0.5*( 1.0 + SIN( PIE*(TST11/DELTF1(N) -0.5) ) )
      DFLAP = SMF*FLAPD
      DTAB  = SMF*TABD
      GO TO 1120
 1080 IF (TST21) 1090,1090,1100
 1090 SMF =  1.0
      DFLAP = SMF*FLAPD
      DTAB  = SMF*TABD
      GO TO 1120
 1100 IF (TST22) 1110,1120,1120
 1110 SMF =   0.5*( 1.0 + SIN( PIE*(TST21/DELTF2(N) +0.5) ) )
      DFLAP = SMF*FLAPD
      DTAB  = SMF*TABD
C
C
 1120 IF (NOAIL) 1210,1210,1130
 1130 SMF =  1.0
      DAILD = SMF*AILD
 1140 IF (TST21) 1150,1150,1160
 1150 SMF =  0.0
      DAILD = SMF*AILD
      GO TO 1210
 1160 IF (TST22) 1170,1180,1180
 1170 SMF =   0.5*( 1.0 + SIN( PIE*(TST21/DELTF2(N) -0.5) ) )
      DAILD = SMF*AILD
      GO TO 1210
 1180 IF (TST31) 1210,1190,1190
 1190 IF (TST32) 1200,1150,1150
 1200 SMF =   0.5*( 1.0 + SIN( PIE*(TST31/DELTF2(N) +0.5) ) )
      DAILD = SMF*AILD
C
 1210 CONTINUE
C
C
      IF (XTAB) 1260,1220,1220
 1220 NOGO = ABS( DTAB) -0.1
      IF (NOGO) 1260,1230,1230
 1230 TANF = TAN( DTAB/RAD )
      COSF = 1.0/SQRT(1.0+TANF**2)
      SINF = TANF*COSF
      DNOR = XTAB*SINF
C
      XCOS =  COSX*COSF - COSZ*SINF
      ZCOS =  COSZ*COSF + COSX*SINF
C
      COSX =  XCOS
      COSZ =  ZCOS
C
      IF (LFLAP) 1240,1240,1250
 1240 P(1) = P(1) - XTAB*(1.0-COSF)
      P(2) = P(2) + DNOR*SIND
      P(3) = P(3) + DNOR*COSD
 1250 CONTINUE
C
C
 1260 NOGO = ABS( DFLAP + DAILD) - 0.1
      IF (NOGO) 1300,1300,1270
 1270 TANF = TAN( (DFLAP + DAILD )/RAD )
      COSF = 1.0/SQRT(1.0 +TANF**2)
      SINF = TANF*COSF
      DNOR = XFLAP*SINF
C
      XCOS = COSX*COSF - COSZ*SINF
      ZCOS = COSZ*COSF + COSX*SINF
C
      COSX = XCOS
      COSZ = ZCOS
C
      IF (LFLAP) 1280,1280,1290
 1280 P(1) = P(1) - XFLAP*(1.0-COSF)
      P(2) = P(2) + DNOR*SIND
      P(3) = P(3) + DNOR*COSD
 1290 CONTINUE
C
C
 1300 CONTINUE
C
      COSN(1) = COSX
      COSN(2) = COSY*COSD + COSZ*SIND
      COSN(3) = COSZ*COSD - COSY*SIND
C
C
 1310 RETURN
C
      END
```

```
▽ FOR A09,A09
C
C
      SUBROUTINE FLAPI(NSF,WA,SHE,XTE,CF,CTAB,TAND,XLE,YLE,ZLE,COS3)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3),COS3(3)
C
C
C
      P(1)= XLE
      P(2)= YLE
      P(3)= ZLE
C
      CALL FLAPS(NSF,WA,SHE,XTE,CF,CTAB,TAND,  P,COS3)
C
      XLE = P(1)
      YLE = P(2)
      ZLE = P(3)
C
C
      RETURN
C
      END


▽ FOR A10,A10
C
C
      SUBROUTINE REFLEC(P,ZL,ALFAR,COSR)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3)
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLDCP
     2 ,IFLG(20), EXECK(15)
C
      NAMELIST/REFLEX/PX,PY,X1,Y1,PHI,ALFAR,RX,RY,ZL,COSR
C
      DATA X2/0.0/, Y2/0.0/
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      PX= P(3)
      PY= P(1)
      X1= ZL/COSR
      Y1= 0.0
      PHI= -ALFAR
      NOTE= IFLG(20) - 15
C
      CALL ROTATE(PX,PY,X1,Y1,PHI,X2,Y2,RX,RY)
C
      IF (NOTE) 1010,1010,1000
 1000 WRITE (KOUT,REFLEX)
 1010 CONTINUE
C
      RX=-RX
C
      CALL ROTATE(RX,RY,X2,Y2,ALFAR,X1,Y1,PX,PY)
C
      IF (NOTE) 1030,1030,1020
 1020 WRITE (KOUT,REFLEX)
      LINES= LINES+24
 1030 CONTINUE
C
      P(3)= PX
      P(1)= PY
C
      RETURN
C     XXXXXX
C
      END


▽ FOR A11,A11
C
C
      SUBROUTINE ISOMET(XLE,YLE,ZLE,REFL,XZER,YZER,ZZER)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      RAD= 57.29578
      PHIR= 45.0/RAD
      PHIP = -PHIR
      PHIQ = 0.5*PHIP
      ZERO = 0.0
      XLE= (XLE-XZER)/REFL
      YLE= (YLE-YZER)/REFL
      ZLE= (ZZER-ZLE)/REFL
C
```

```
      CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHIR, ZERO,ZERO, XLE,ZLE  )
      CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE  )
      CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE  )
C
      RETURN
C     XXXXXX
C
      END


V FOR A12,A12
C
C
      SUBROUTINE ROTATE( X,Y, XO,YO, PHI,  XF,YF, XT,YT )
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      XS = X-XO
      YS = Y-YO
      RHO= SQRT( XS**2 + YS**2)
      ERROR= 0.0001
      TESTX= ABS(XS)-ERROR
      TESTY= ABS(YS)-ERROR
      IF (TESTX) 1000,1C00,1030
 1000 IF (TESTY) 1010,1010,1020
 1010 ZET= 0.0
      GO TO 1110
 1020 ZET= 1.570795*(YS/ABS(YS)) - XS/YS
      GO TO 1110
 1030 ZET= ABS(YS/XS)
      IF (TESTY) 1050,1C50,1040
 1040 ZET=ATAN(ZET)
 1050 CONTINUE
      IF (XS) 1070,1060,1060
 1060 IF (YS) 1100,1110,1110
 1070 IF (YS) 1090,108C,1080
 1080 ZET= 3.14159 - ZET
      GO TO 1110
 1090 ZET= 3.14159 + ZET
      GO TO 1110
 1100 ZET= 6.28318 - ZET
 1110 CONTINUE
      ZPP= PHI + ZET
      XR = RHO*COS(ZPP)
      YR = RHO*SIN(ZPP)
      XT= XF + XR
      YT= YF + YR
C
      RETURN
C     XXXXXX
C
      END


V FOR A13,A13
C
C
      SUBROUTINE VORTEX(P,B,D,TANA,GAMA,      VI,VCOS)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3),B(3),D(3)
      DIMENSION COS1(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)
      DIMENSION G(3)
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINX
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
      NAMELIST/DBUGV1/P,B,D,TANA,GAMA,PSIF,VCOS
      NAMELIST/DBUGV2/PSIF,VCOS
      NAMELIST/DBUGV3/PSIF,VCOS
C
 1000 FORMAT(1X,//,1X)
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      NOTE= IFLG(20) - 8
      TANAS= TANA**2
      COSA= 1.0 - TANAS/2.0
      IF (TANAS-0.0001) 1020,1010,1010
 1010 COSA= 1.0/SQRT(TANAS+1.0)
 1020 SINA= COSA*TANA
C
      SCALE= SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)
      DO 1030 K=1,3
      X(K)= (P(K)-0.5*(B(K)+D(K)))/SCALE
      A(K)= (0.5*(D(K)-B(K)))/SCALE
 1030 VCOS(K)= 0.0
C
C
C
C   * SEGMENT INF-A-B *
C
      H5  =  TANA*( X(1)+ A(1))
C
```

```
      HS1 =  (X(1)+A(1))**2  + H5**2
      HS2 =  (X(2)+A(2))**2  + (X(3)+A(3)-H5)**2
      HS3 =  (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
      H1  =  SQRT(HS1)
      H2  =  SQRT(HS2)
C
      COSG= 0.0
      SING= 1.0
      TEST = CUTOF1 - H1
C
      IF (TEST) 1040,1050,1050
 1040 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
      SING= SQRT(ABS(1.0-COSG**2))
 1050 CONTINUE
C
      R   =  H2*SING
      H4  =  H2*COSG
      SH14=  H1+H4
C
      PSIF= ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R
C
      COS1(1) =  COSA
      COS1(2) =  0.0
      COS1(3) =  SINA
      COS2(1) = ( X(1)+A(1)-SH14*COSA )/R
      COS2(2) = ( X(2)+A(2) )/R
      COS2(3) = ( X(3)+A(3)-SH14*SINA )/R
C
      CALL CROSP( COS1,COS2,COS3)
C
      DO 1060 K=1,3
 1060 VCOS(K)=  PSIF*CCS3(K)
C
      IF (NOTE) 1080,1070,1070
 1070 WRITE (KOUT,1000)
      WRITE (KOUT,DBUGV1)
 1080 CONTINUE
C
C
C
C    * SEGMENT D-E-INF *
C
      H5   = TANA*(X(1)-A(1))
C
      HS1 = (X(1)-A(1))**2 + H5**2
      HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2
      HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
      H1  = SQRT(HS1)
      H2  = SQRT(HS2)
C
      COSG= 0.0
      SING= 1.0
      TEST = CUTOF1 - H1
C
      IF (TEST) 1090,1100,1100
 1090 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
      SING= SQRT(ABS(1.0-COSG**2))
 1100 CONTINUE
C
      R    = H2*SING
      H4   = H2*COSG
      SH14= H1+H4
C
      PSIF= (-1.0 -SH14/SQRT(SH14**2+R**2) )/R
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= SINA
      COS2(1)=  ( X(1)-A(1)-SH14*COSA )/R
      COS2(2)=  ( X(2)-A(2) )/R
      COS2(3)=  ( X(3)-A(3)-SH14*SINA )/R
C
      CALL CROSP(COS1,COS2,COS3)
C
      DO 1110 K=1,3
 1110 VCOS(K)= VCOS(K) +  PSIF*COS3(K)
C
      IF (NOTE) 1130,1120,1120
 1120 WRITE (KOUT,DBUGV2)
 1130 CONTINUE
C
C
C
C    * SEGMENT B-C-D *
C
      HS1 =   4.0*( A(1)**2 + A(2)**2 + A(3)**2 )
      HS2 =  (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
      HS3 =  (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
      H1  =  SQRT(HS1)
      H2  =  SQRT(HS2)
C
      COSG=  (HS3-HS1-HS2)/(2.0*H1*H2)
      SING=  SQRT(ABS(1.0-COSG**2))
      PSIF= 0.0
      TEST =  ABS(SING) - CUTOF2
C
      IF (TEST) 1170,1170,1140
 1140 CONTINUE
C
      R    =  H2*SING
C
      TEST = R/H1 - 10.0*CUTOF1
      IF (TEST) 1170,1170,1150
 1150 CONTINUE
C
      RS   =  R**2
```

```
      H4  =  H2*COSG
      SH14=  H1+H4
      T1= 1.0 + 2.0*H4/H1
C
      PSIF= (SH14/SQRT(SH14**2+RS) -H4/SQRT(H4**2+RS))/R
C
      DO 1160 K=1,3
      G(K)= A(K)*T1
      COS1(K)= (G(K)-X(K))/R
 1160 COS2(K)= -2.0*A(K)/H1
C
      CALL CROSP(COS1,COS2,COS3)
C
 1170 CONTINUE
C
      V2= 0.0
C
      DO 1180 K=1,3
      VCOS(K)= VCOS(K) + PSIF*COS3(K)
 1180 V2= V2 + VCOS(K)**2
C
      IF (NOTE) 1200,1190,1190
 1190 WRITE (KOUT,DBUGV3)
      LIN= LINX - 10
 1200 CONTINUE
C
      VI= SQRT(V2)
      DO 1210 K=1,3
 1210 VCOS(K)= VCOS(K)/VI
C
      VI= VI*(GAMA/SCALE)
C
      RETURN
C     XXXXXX
C
      END


∇ FOR A14,A14
C
C
      SUBROUTINE DMATIN(A,N,DETERM)
C
C     MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
C   * VERSION 2 ROUTINE (DOUBLE PRECISSION-LANGLEY MATINV SUBROUTINE) *
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DOUBLE PRECISION R1,R2,DETERM,AMAX,T,SWAP,PIVOT,PIVOTI
      DOUBLE PRECISION A(100,100), B(1,1)
      DIMENSION IPIVOT(100),INDEX(100,2)
      EQUIVALENCE (IROW,JROW), (ICOLUM,JCOLUM), (AMAX, T, SWAP)
      M= 0
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C     INITIALIZATION
C
 1000 ISCALE=0
 1010 R1 = 1.E36
 1020 R2=1.0/R1
 1030 DETERM=1.0
 1040 DO 1050 J=1,N
 1050 IPIVOT(J)=0
 1060 DO 1630 I=1,N
C
C     SEARCH FOR PIVOT ELEMENT
C
 1070 AMAX=0.0
 1080 DO 1170 J=1,N
 1090 IF (IPIVOT(J)-1) 1100,1170,1100
 1100 DO 1160 K=1,N
 1110 IF (IPIVOT(K)-1) 1120,1160,1750
 1120 IF (DABS(AMAX)-DABS(A(J,K))) 1130,1160,1160
 1130 IROW=J
 1140 ICOLUM=K
 1150 AMAX=A(J,K)
 1160 CONTINUE
 1170 CONTINUE
      IF (AMAX) 1190,1180,1190
 1180 DETERM=0.0
      ISCALE=0
      GO TO 1750
C     XXXXXX
C
C
 1190 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C
C     INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
C
 1200 IF (IROW-ICOLUM) 1210,1310,1210
 1210 DETERM=-DETERM
 1220 DO 1250 L=1,N
 1230 SWAP=A(IROW,L)
 1240 A(IROW,L)=A(ICOLUM,L)
 1250 A(ICOLUM,L)=SWAP
C
C
 1260 IF (M) 1310,1310,1270
 1270 DO 1300 L=1,M
```

```
 1280 SWAP=B(IROW,L)
 1290 B(IROW,L)=B(ICOLUM,L)
 1300 B(ICOLUM,L)=SWAP
 1310 INDEX(I,1)=IROW
 1320 INDEX(I,2)=ICOLUM
 1330 PIVOT=A(ICOLUM,ICOLUM)
      IF (PIVOT) 1340,1180,1340
C
C     SCALE THE DETERMINANT
C
 1340 PIVOTI=PIVOT
 1350 IF (DABS(DETERM)-R1) 1380,1360,1360
 1360 DETERM=DETERM/R1
      ISCALE=ISCALE+1
      IF (DABS(DETERM)-R1) 1410,1370,1370
 1370 DETERM=DETERM/R1
      ISCALE=ISCALE+1
      GO TO 1410
 1380 IF (DABS(DETERM)-R2) 1390,1390,1410
 1390 DETERM=DETERM*R1
      ISCALE=ISCALE-1
      IF (DABS(DETERM)-R2) 1400,1400,1410
 1400 DETERM=DETERM*R1
      ISCALE=ISCALE-1
 1410 IF (DABS(PIVOTI)-R1) 1440,1420,1420
 1420 PIVOTI=PIVOTI/R1
      ISCALE=ISCALE+1
      IF (DABS(PIVOTI)-R1) 1470,1430,1430
 1430 PIVOTI=PIVOTI/R1
      ISCALE=ISCALE+1
      GO TO 1470
 1440 IF (DABS(PIVOTI)-R2) 1450,1450,1470
 1450 PIVOTI=PIVOTI*R1
      ISCALE=ISCALE-1
      IF (DABS(PIVOTI)-R2) 1460,1460,1470
 1460 PIVOTI=PIVOTI*R1
      ISCALE=ISCALE-1
 1470 DETERM=DETERM*PIVOTI
C
C     DIVIDE PIVOT ROW BY PIVOT ELEMENT
C
 1480 A(ICOLUM,ICOLUM)=1.0
 1490 DO 1500 L=1,N
 1500 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT
C
C
 1510 IF (M) 1540,1540,1520
 1520 DO 1530 L=1,M
 1530 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT
C
C     REDUCE NON-PIVOT ROWS
C
 1540 DO 1630 L1=1,N
 1550 IF (L1-ICOLUM) 1560,1630,1560
 1560 T=A(L1,ICOLUM)
 1570 A(L1,ICOLUM)=0.0
 1580 DO 1590 L=1,N
 1590 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
C
C
 1600 IF (M) 1630,1630,1610
 1610 DO 1620 L=1,M
 1620 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
 1630 CONTINUE
C
C     INTERCHANGE COLUMNS
C
 1640 DO 1740 I=1,N
 1650 L=N+1-I
 1660 IF (INDEX(L,1)-INDEX(L,2)) 1670,1740,1670
 1670 JROW=INDEX(L,1)
 1680 JCOLUM=INDEX(L,2)
 1690 DO 1730 K=1,N
 1700 SWAP=A(K,JROW)
 1710 A(K,JROW)=A(K,JCOLUM)
 1720 A(K,JCOLUM)=SWAP
 1730 CONTINUE
 1740 CONTINUE
 1750 RETURN
C     XXXXXX
C
      END


V FOR A15,A15
C
C
      SUBROUTINE DOTP(A,B,C)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION A(3),B(3)
      C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3)
C
      RETURN
C     XXXXXX
C
      END


V FOR A16,A16
```

```
C
C
      SUBROUTINE CROSP( A,B,C)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION A(3),B(3),C(3)
C
      C(1)= A(2)*B(3) - A(3)*B(2)
      C(2)= A(3)*B(1) - A(1)*B(3)
      C(3)= A(1)*B(2) - A(2)*B(1)
C
      RETURN
C     XXXXXX
C
      END


V FOR A17,A17
C
C
      SUBROUTINE PAGE
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION AILROX(2)
C
      COMMON/DATA00/ TITLE(14), ALFA0, ZHO, CMAK
C
      COMMON/DATA01/ KIN, KOUT, KT1, KT2, KT3, KREC, KFILE, LIN, LINK
     1 ,RAD, PIE, CUTOF1, CUTOF2, DELALF, LFLAP, LDRAG, COLOCP
     2 ,IFLG(20), EXECK(15)
C
C
 1000 FORMAT(70H1JOBFLAG  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16
     1 17 18 19 20  ,9A6,6H  PAGE,/,
     2 2X,5HVALUE,1X,20I3, 7X,5HALFA=,F6.2,9H  MACHNO=,F6.4,11H  ALTITUD
     3F=,F6.2, 7X,I4,//,1X)
C
C
C    XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
      IF (NSTU-1971) 1010,1020,1010
 1010 NSTU= 1971
      FLAPOX   = 0.0
      AILROX(1)= 0.0
      AILROX(2)= 0.0
      NP= 0
 1020 NP= NP+1
      WRITE (KOUT,1000)(TITLE(I),I=1,9),(IFLG(I),I=1,20),ALFA0,CMAK,ZHO,
     *NP
      LIN= 5
C
      RETURN
C     XXXXXX
C
      END


V FOR A18,A18
C
C
C     MAIN ROUTINE
C     TEST MATRIX INVERSION
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON JUNE-JULY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DOUBLE PRECISION DELTA,AMAT(60,60),CMAT(60,60)
      DOUBLE PRECISION BMAT(100,100)
C
 1000 FORMAT((10X,I5,2F14.4 ) )
 1010 FORMAT( 1X,/,1X )
 1020 FORMAT((10X,5(1PE14.6) ))
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      NOR= 5
C
      AMAT(1,1) = 1.032
      AMAT(1,2) = 7.865
      AMAT(1,3) = 3.216
      AMAT(1,4) = 3.031
      AMAT(1,5) = 10.32
      AMAT(2,1) = 7.68
      AMAT(2,2) = -6.35
      AMAT(2,3) = 8.900
      AMAT(2,4) = -1.03
      AMAT(2,5) = 5.690
      AMAT(3,1) = 3.030
      AMAT(3,2) = -3.38
      AMAT(3,3) = -11.67
      AMAT(3,4) = 4.190
```

```
      AMAT(3,5) = -3.60
      AMAT(4,1) = -2.93
      AMAT(4,2) = 5.670
      AMAT(4,3) = 8.323
      AMAT(4,4) = 9.073
      AMAT(4,5) = 0.0378
      AMAT(5,1) = -.0578
      AMAT(5,2) = 7.103
      AMAT(5,3) = 9.992
      AMAT(5,4) = 0.578
      AMAT(5,5) = 15.14
C
      DO 1040 J=1,NOR
      DO 1030 K=1,NOR
 1030 BMAT(J,K)= AMAT(J,K)
 1040 CONTINUE
C
      CALL DMATIN(BMAT,NOR,DELTA)
C
      DO 1070 K=1,NOR
      DO 1060 J=1,NOR
      CMAT(J,K)= 0.0
      DO 1050 L=1,NOR
 1050 CMAT(J,K)=  CMAT(J,K) + AMAT(J,L)*BMAT(L,K)
 1060 CONTINUE
 1070 CONTINUE
C
      CALL PAGE
      WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((BMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1010)
      WRITE (6,1020)DELTA
      STOP
      END
```

```
V FOR B01,B01
C
C
C
C    * MAIN ROUTINE WING  /WING LIFT PROGRAM HADLOB/REVISED 15 MARCH 71 *
C
C    * THEORY AND PROGRAM DEVELOPED BY ANTULIO V. GOMEZ,STAFF ENGINEER *
C    * TRW SYSTEMS GROUP, DIVISION OF TRW INC., HOUSTON, TEXAS - 77058 *
C    * VERSION 2 ROUTINE (DOUBLE PRECISSION-LANGLEY MATINV SUBROUTINE) *
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      REAL MACHN(10)
      DIMENSION COMMTS(42)
      DIMENSION YSPAN(42)
      DIMENSION WCL(21),ALFA(20),HEIGHT(10)
      DIMENSION FLAPD(10), AILRND(2,10)
      DIMENSION FLAPDJ(10), AILDJ(2,10)
C
      COMMON/DATA00/NSTL  ,ALFAO ,CMAK  ,ZHO   ,FLAPDX,AILRDX(2)
     *       ,TITLE(14)    ,STORE(14)
C
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2   ,LINEX ,LINES
C
      COMMON/DATA02/IFLG(15)      ,EXECK(15)     ,RAD    ,PIE
C
      COMMON/DATA03/NYS   ,NCS   ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10)
     *      ,C(10) ,ZOC(10 ,10)   ,XOC(10)
C
      COMMON/DATA04/YFLAP1,YFLAP2,FLAPC
     *             ,YAILRN,AILRNC,WSMOTH
C
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2
     *             ,NOFLAP,NOAILR
C
      COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2
C
      EQUIVALENCE (LINX,LINEX),(NSS,NYS),(XOCR,XOCREF)
      EQUIVALENCE (WFLAP1,YFLAP1),(WFLAP2,YFLAP2),(WFLAP3,YAILRN)
      EQUIVALENCE (FLAPDJ,FLAPD),(AILDJ,AILRND)
C
C
      NAMELIST/INPUT/ KOUT, KT1, KT2, KT3, LINX, COLOCP,
     1 CUTOF1, CUTOF2, LFLAP, LDRAG, PMECF, DELALF,
     2 NSS, NCS, X, Y, Z, E, C, XOC, ZOC, XOCR,
     3 WFLAP1,WFLAP2,WFLAP3,FLAPC, WSMOTH, YSPAN,
     4 NJOB, NJOBL, ALFA, MACHN, HEIGHT, FLAPDJ, AILDJ, WCL, CLEANF,
     5 IFLG
C
      DATA TEST/6H $ENDJ/
      DATA NJOB/1/, NJOBL/20/, ALFA/20*0.0/
      DATA WCL/1.0,  -0.4,-0.3,-0.2,-0.1,0.0,0.1,0.2,0.3,0.4,0.5,0.6,
     *  0.8,0.9,1.0,1.1,1.2,1.3,1.4,1.5,1.6/
      DATA MACHN/10*0.0/, HEIGHT/10*10000.0/
      DATA AILRND/20*0.0/, FLAPD/10*0.0/
      DATA PMECF/1.0/, COLOCP/0.75/, CLEANF/0.0035/, DELALF/1.0/
C
C
 1000 FORMAT(13A6,A2)
C
 1010 FORMAT(//,15X,14H**** JOB TIME=,I4,16H / ELAPSED TIME=,I4,
     1 17H / NO.PLOT FILES=,I4,35H / ISURF EXEC. VERSION 6-18-72 ****,
```

```
    2 //,15X,47(2H**),/,15X,47(2H**) )
C
 1020 FORMAT(1H1,10X,35H**** JOBS INPUT LIST-CONTINUED ****,/,1X )
 1030 FORMAT(1X,13A6,A2)
 1040 FORMAT(1X,11H7 XCT (SURF)
C
 1050 FORMAT(1H1,///,///,29X,
     1 53HSUBSONIC-FLOW LIFTING SURFACE ANALYSIS PROGRAM HA010B,//,37X,
     2 36HTRW SYSTEMS INC., HOUSTON OPERATIONS,//,44X,
     3 22HHOUSTON, TEXAS (77058),///,16X,
     4 25H**** JOBS INPUT LIST ****,/, 1X )
C
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
      CALL BLKDAT
      REWIND KT1
      WRITE (KOUT,1050)
      WRITE (KOUT,1050)
      WRITE (KOUT,1040)
      LINES= 15
 1060 READ (KIN,1000)(STORE(I),I=1,14)
      WRITE (KT1,1000)(STORE(I),I=1,14)
      IF (LINEX-LINES) 1070,1080,1080
 1070 WRITE (KOUT,1020)
      LINES= 3
 1080 LINES= LINES+1
      WRITE (KOUT,1030)(STORE(I),I=1,14)
C
      IF (STORE(1).NE.TEST) GO TO 1060
      END FILE KT1
      REWIND KT1
      WRITE (KOUT,1040)
C
      NCOMT=-1
      NCALCP=-1
      TSUM = 0.0
      CALL RESET
C
C
 1090 READ (KT1,1000)(TITLE(I),I=1,14)
      IF(TITLE(1).EQ.TEST) CALL EXIT
      IF (NCOMT) 1100,1100,1110
 1100 READ (KT1,1000)(COMMTS(I),I=1,42)
 1110 NCOMT= 1
      READ (KT1,INPUT)
      ALFAO= 1.0E+10
      ZHO  = 1.0E+10
      EXECK(10)= CLEANF
      EXECK(11)= COLOCP
      EXECK(12)= DELALF
      EXECK(13)= PMECF
      IPLOTK= IFLG(12) + IFLG(13) + IFLG(14) - 1
C
      IF (NCALCP) 1120,1120,1140
 1120 NCALCP= 1
      IF (IPLOTK) 1140,1130,1130
 1130 REWIND KT2
      IFLG(15)= 0
 1140 CONTINUE
C
C
      CALL PAGE
      WRITE (KOUT,INPUT)
C
      ITEST=70-(IFLG(6)*IFLG(3))/(2-IFLG(1))
      IF (ITEST) 1150,1160,1160
 1150 IFLG(3)= 70*(2-IFLG(1))/IFLG(6)
 1160 IFLGX3= 21*(2/(IFLG(1)+1))
      IF (IFLGX3-IFLG(3)) 1170,1180,1180
 1170 IFLG(3)= IFLGX3
 1180 CONTINUE
C
      AILRDX(1) = AILRND(1,1)  + AILRND(1,2)
      AILRDX(2) = AILRND(2,1)  + AILRND(2,2)
      FLAPDX=  FLAPD(1)      + FLAPD(2)
C
      NOAILR = 0
      NOFLAP= 0
      IFLG(1)= 0
      UTEST= ABS( AILRDX(1) - AILRDX(2) ) -0.5
C
      IF (UTEST) 1200,1200,1190
 1190 IFLG(1)= 1
      NOAILP= 2
 1200 IF (FLAPDX) 1210,1220,1210
 1210 NOFLAP = 2
 1220 NOFLPX= NOFLAP + NOAILP
      IF (NOFLPX) 1290,1250,1230
 1230 IF (IFLG(5)) 1240,1240,1250
 1240 IFLG(5)= 1
 1250 IF (IFLG(6)-1) 1260,1260,1270
 1260 IFLG(6)= 2
 1270 IF (IFLG(2)-5) 1290,1280,1280
 1280 IFLG(2)= 4
 1290 CONTINUE
C
      AILRDX(1) = 0.0
      AILRDX(2) = 0.0
      FLAPDX=  0.0
      NJOBX= NJOBL+1
C
C
      CALL LOFT(YSPAN)
C
```

```
C                                                                       B01 1720
      DO 1360 N=1,NJOB                                                  B01 1730
C                                                                       B01 1740
      ALFAO= ALFA(N)                                                    B01 1750
      HEIGT= HEIGHT(N)                                                  B01 1760
      ALFAO= ALFAO                                                      B01 1770
      ZHO  = HEIGT                                                      B01 1780
      CMAK = 0.0                                                        B01 1790
      EXECK(1)= 1.0                                                     B01 1800
      IF (MACHN(N)-0.55) 1300,1300,1310                                 B01 1810
 1300 CMAK = MACHN(N)                                                   B01 1820
      EXECK(1)= SQRT(1.0-CMAK**2)                                       B01 1830
 1310 FLAPDX= FLAPD(N)                                                  B01 1840
      AILRDX(1)= AILRND(1,N)                                            B01 1850
      AILRDX(2)= AILRND(2,N)                                            B01 1860
C                                                                       B01 1870
      CALL DLIFT(ALFAD,HEIGT)                                           B01 1880
C                                                                       B01 1890
C                                                                       B01 1900
      IF (IFLG(8)-1) 1330,1320,1320                                     B01 1910
 1320 CALL DLINER(ALFAC,HEIGT,ALFA,WCL,NJOBX)                           B01 1920
 1330 CONTINUE                                                          B01 1930
C                                                                       B01 1940
      CALL TIME(IMS)                                                    B01 1950
      IS= IMS/1000                                                      B01 1960
      ISJB= IS-ISUM                                                     B01 1970
      ISUM= IS                                                          B01 1980
C                                                                       B01 1990
      LINES= LINES +6                                                   B01 2000
      IF (LINEX-LINES) 1340,1350,1350                                   B01 2010
 1340 CALL PAGE                                                         B01 2020
 1350 WRITE (KOUT,1010)ISJB,IS,IFLG(15)                                 B01 2030
      LINES= LINES + LINEX                                              B01 2040
C                                                                       B01 2050
 1360 CONTINUE                                                          B01 2060
C                                                                       B01 2070
      GO TO 1090                                                        B01 2080
C                                                                       B01 2090
C                                                                       B01 2100
      END                                                               B01 2110
```

```
▽ FOR B02,B02                                                           B02   10
C                                                                       B02   20
C                                                                       B02   30
C                                                                       B02   40
      SUBROUTINE BLKDAT                                                 B02   50
C                                                                       B02   60
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B02   70
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B02   80
C                                                                       B02   90
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB02  100
C                                                                       B02  110
      COMMON/DATA00/NSTU  ,ALFAO ,CMAK  ,ZHO    ,FLAPDX,AILRDX(2)       B02  120
     *       ,TITLE(14)     ,STORE(14)                                  B02  130
C                                                                       B02  140
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2    ,LINEX ,LINES           B02  150
C                                                                       B02  160
      COMMON/DATA02/IFLG(15)      ,EXECK(15)     ,RAD   ,PIE            B02  170
C                                                                       B02  180
      COMMON/DATA03/NYS   ,NCS   ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10)     B02  190
     *      ,C(10) ,ZOC(10 ,10)   ,XOC(10)                              B02  200
C                                                                       B02  210
      COMMON/DATA04/YFLAP1,YFLAP2,FLAPC                                 B02  220
     *              ,YAILRN,AILRNC,WSMOTH                               B02  230
C                                                                       B02  240
      COMMON/DATA05/WINGD(15)     ,FY(42,10)     ,EC(42,10)     ,ES(42,10) B02  250
     *,EYE(10)      ,FLE(10)      ,ETE(10)       ,EHE(10)       ,EG(42,10) B02  260
     *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)                        B02  270
C                                                                       B02  280
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2   B02  290
     *              ,NOFLAP,NOAILR                                      B02  300
C                                                                       B02  310
      COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2                           B02  320
C                                                                       B02  330
C                                                                       B02  340
      DATA NSTU/1/, ALFAO/0.0/, CMAK/0.0/, ZHO/10000.0/,FLAPDX/0.0/,    B02  350
     * AILRDX/2*0.0/                                                    B02  360
C                                                                       B02  370
      DATA KIN/5/, KOUT/6/, KT1/1/, KT2/8/, LINEX/56/, LINES/0/         B02  380
C                                                                       B02  390
      DATA IFLG/0,0,10,0,0,1,0,0,0,1,5*0/, EXECK/15*0.0/, RAD/57.29578/,B02  400
     * PIE/3.14159/                                                     B02  410
C                                                                       B02  420
      DATA NYS/2/,NCS/2/,XOCREF/0.25/,X/10*0.0/,Y/0.0,100.0,8*1000.0/,  B02  430
     * Z/10*0.0/,F/10*0.0/,C/10*100.0/,ZOC/100*0.0/,XOC/0.0,1.0,8*0.0/  B02  440
C                                                                       B02  450
      DATA YFLAP1/0.0/, YFLAP2/0.6/, FLAPC/0.3/, YAILRN/1.3/, AILRNC/.3/B02  460
     *, WSMOTH/0.20/                                                    B02  470
C                                                                       B02  480
      DATA LFLAP/0/, LDRAG/0/, CUTOF1/0.0001/, CUTOF2/0.0029/           B02  490
C                                                                       B02  500
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB02  510
C                                                                       B02  520
      RETURN                                                            B02  530
C                                                                       B02  540
      END                                                               B02  550
```

```
▽ FOR B03,B03                                                           B03   10
C                                                                       B03   20
C                                                                       B03   30
C                                                                       B03   40
      SUBROUTINE LOFT(YSPAN)                                            B03   50
```

```
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
       DIMENSION XV(10),XN(10),XC(10)
       DIMENSION YSPAN(42)
       DIMENSION COS1(3),COS2(3),COS3(3)
       DIMENSION ZOCY(10)
C
       COMMON/DATA01/KIN    ,KOUT   ,KT1    ,KT2    ,LINEX ,LINES
C
       COMMON/DATA02/IFLG(15)       ,FXECK(15)      ,RAD    ,PIE
C
       COMMON/DATA03/NYS    ,NCS    ,XOCREF,X(10) ,Y(10) ,Z(10) ,E(10)
     *        ,C(10) ,ZOC(10 ,10)   ,XOC(10)
C
       COMMON/DATA04/YFLAP1,YFLAP2,FLAPC
     *                ,YAILRN,AILRNC,WSMOTH
C
       COMMON/DATA05/WINGD(15)       ,EY(42,10)      ,EC(42,10)      ,ES(42,10)
     *,EYF(10)        ,ELE(10)        ,ETE(10)        ,EHE(10)        ,EG(42,10)
     *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)
C
       COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2
     *                ,NOFLAP,NOAILR
C
C
 1000 FORMAT(1X,//,1X)
C
 1010 FORMAT(53X,13HWING GEOMETRY,/,53X,13(1H*),///,1X,
     1 60H      SPAN        ROOT       TIP       ROOT        TIP       AREA ,
     2 59H    ASPECT      MEAN     MGC          YBAR        XBAR       ZBAR,/,
     361H                 CHORD      CHORD      TWIST       TWIST           ,
     4 60H     RATIO      CHORD      (MAC)      (MGC)       (MGC)      (MGC),/
     5/,1X,3F10.3,2F10.4,F10.2,F10.4,5F10.3,//,1X,
     6 60H      FLAP        FLAP       FLAP      AILRN       AILRN     AILRN,
     7 60H      DIHEO       SWEEP   NO.SPAN   NO.SPAN   NO.CHORD  NO.CHORD/,
     861H       SPAN1       SPAN2      CHORD      SPAN1       SPAN2      CHORD,
     9 60H     1/4MGC      1/4MGC   VORTICES   DISCONT   VORTICES   DISCONT/,
     */,1X,2(2F10.3,F1C.4),2F10.3,I7,3I10,///,1X )
C
 1020 FORMAT(1X)
C
 1030 FORMAT(1X,
     1 60H     2Y/B          Y            XLE        X(1/4)       XHE        XTE  ,
     2 60H        Z           E         SWEEP C/4     DIHED         C          CF   ,
     3 /,1X)
 1040 FORMAT( 1X, 12F1C.3 )
C
 1050 FORMAT(21X,50H    XA(1)/C    XA(2)/C    XA(3)/C    XA(4)/C    XA(5)/C,
     1 50H    XA(6)/C    XA(7)/C    XA(8)/C    XA(9)/C   XA(10)/C,//,21X,
     2 10F10.4,///,1X,      40H         Y          2Y/8  ,  ZA(1)/C,  ZA(2)/C,
     3 60H    ZA(3)/C    ZA(4)/C    ZA(5)/C    ZA(6)/C    ZA(7)/C    ZA(8)/C,
     4 20H    ZA(9)/C   ZA(10)/C,/,1X )
 1060 FORMAT( 1X,12F10.4 )
C
 1070 FORMAT(3X,1HJ,2X,1HK,5X,1HY,9X,2HDY,8X,2HDC,8X,2HDS,/,1X )
 1080 FORMAT(1X,2I3,12(1PE10.3) )
C
 1090 FORMAT(3X,1HJ,2X,1HK,5X,2HXV,8X,2HYV,8X,2HZV,8X,3H1XV,7X,3H1YV,7X,
     * 3H1ZV,7X,2HXN,8X,2HYN,8X,2HZN,8X,3H1XN,7X,3H1YN,7X,3H1ZN,/,1X)
 1100 FORMAT( 1X, 2I3, 12(1PE10.3)    )
C
 1110 FORMAT(5X,1HB,9X,2HCR,8X,2HCT,8X,2HER,8X,2HET,8X,1HS,9X,2HAR,8X,
     * 2HMC,8X,3HMGC,6X,4HYMGC,6X,4HXMGC,6X,4HZMGC,/,1X)
 1120 FORMAT(1X,12F10.3 )
C
 1130 FORMAT(1X,/,1X,14H(EOF PLOT FILE,I3,1H)   )
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C    * FILL IN NYS + 1 SPACE *
C
       SPAN= 2.0*Y(NYS)
       WINGD( 1) =  SPAN
       WINGD( 2) =  C(1)
       WINGD( 3) =  C(NYS)
       WINGD( 4) =  E(1)
       WINGD( 5) =  E(NYS)
C
       BOTU= SPAN/2.0
       DELTF1= WSMOTH
       DELTF2= WSMOTH
C
       IF (WSMOTH-1.0) 1140,1150,1150
 1140 DELTF1=  BOTU*DELTF1
       DELTF2=  BOTU*DELTF2
 1150 CONTINUE
C
       YFF11 = YFLAP1
       YFF21 = YFLAP2
       YFF31 = YAILRN
C
       IF (YFLAP2-1.01) 1160,1170,1170
 1160 YFF11 = YFF11*BOTU
       YFF21 = YFF21*BOTU
       YFF31 = YFF31*BOTU
 1170 YFF11 = YFF11 - 0.5*DELTF1
       YFF21 = YFF21 - C.5*DELTF2
       YFF31 = YFF31 - C.5*DELTF2
C
       YFF12= YFF11 + DELTF1
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```
      YFF22= YFF21 + DELTF2
      YFF32 = YFF31 + DELTF2
C
      NY1= NYS-1
      NY2= NYS+1
      Y(NY2)= Y(NYS) +  0.20*(Y(NYS)-Y(NY1))
      RAT=(Y(NY2)-Y(NY1))/(Y(NYS)-Y(NY1))
      X(NY2)=  X(NYS) + RAT*( X(NYS) - X(NY1))
      Z(NY2)=  Z(NYS) + RAT*( Z(NYS) - Z(NY1))
      E(NY2)=  E(NYS) + RAT*( E(NYS) - E(NY1))
      C(NY2)=  C(NYS) + RAT*( C(NYS) - C(NY1))
      DO 1180 L=1,NCS
 1180 ZOC(L,NY2)= ZOC(L,NYS) + RAT*( ZOC(L,NYS) - ZOC(L,NY1) )
C
      L= NCS
      L1= L-1
      L2= L+1
      NCSP1= L2
      XOC(L2)=  XOC(L) + 0.10*(XOC(L)-XOC(L1))
      RAT= ( XOC(L2)-XOC(L) )/( XOC(L)-XOC(L1) )
      DO 1190 N=1,NY2
 1190 ZOC(L2,N)= ZOC(L,N) + RAT*( ZOC(L,N)-ZOC(L1,N) )
C
C
C
C   * CALCULATE SPAN FUNCTIONS *
C
      NSPV=  IFLG(3)
      NSPS= NSPV + 1
      NDIS= IFLG(2)
      IFLAG= IFLG(4)
C
      CALL SPANI(IFLAG,NSPS,NDIS,SPAN,  YSPAN)
C
      DO 1220 L=1,NY2
      EYE(L)=  Y(L)
      ELE(L)=  X(L) - XOCREF*C(L)
      ETE(L)=  ELE(L) + C(L)
      CF    =  FLAPC
      IF (FLAPC-0.8) 1200,1200,1210
 1200 CF    =  CF*C(L)
 1210 EHE(L)=  ETE(L) - CF
 1220 CONTINUE
C
C
C
C
C   * CALCULATE CHORD FUNCTIONS *
C
      IFLAG=  IFLG(7)
      NCV  =  IFLG(6)
      NDIS =  IFLG(5)
      NOFLPX = NOFLAP + NOAILR
C
      IF (NOFLPX) 1240,1240,1230
 1230 NCV = NCV -1
      NDIS= NDIS-1
 1240 CONTINUE
C
      CALL CHORDI(IFLAG,NCV,NDIS,  XV,XN,XC)
C
      DO 1280 J=1,NSPS
C
      YF= YSPAN(J)
C
      CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
      IF (NOFLPX) 1260,1260,1250
 1250 CW= CW-CF
 1260 CONTINUE
C
      DO 1270 L=1,NCV
      EC(J,L)= XLE + XC(L)*CW
      EY(J,L)= YF
      EV(J,L,1)=  XLE + XV(L)*CW
      EV(J,L,2)=  YF
      EV(J,L,3)=  0.0
      EN(J,L,1)=  XLE + XN(L)*CW
      EN(J,L,2)=  YF
 1270 EN(J,L,3)=  0.0
C
 1280 CONTINUE
C
C
      IF (NOFLPX) 1310,1310,1290
 1290 CONTINUE
C
      NCV= NCV + 1
C
      DO 1300 J=1,NSPS
      YF= YSPAN(J)
C
      CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
      EY(J,NCV)= YF
      EC(J,NCV) = XTE
      EV(J,NCV,1)= XHE + 0.25*CF
      EV(J,NCV,2)=  YF
      EV(J,NCV,3)=  0.0
      EN(J,NCV,1)= XHE + 0.75*CF
      EN(J,NCV,2)=  YF
 1300 EN(J,NCV,3)=  0.0
C
 1310 CONTINUE
C
C
```

```
      NCVP1 = NCV +1
C
      DO 1370 J=1,NSPS
      J2= J+1
      YF= YSPAN(J)
C
      CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
      IF (J-NSPS) 1320,1340,1340
 1320 CONTINUE
      DO 1330 K=1,NCV
 1330 EY(J,K)= EY(J2,K)-EY(J,K)
 1340 CONTINUE
C
      EV(J,NCVP1,1) = XTE
      EV(J,NCVP1,2) = YF
      EV(J,NCVP1,3) = 0.0
      EC(J,NCVP1)   =  0.0
C
      DO 1350 K=1,NCV
 1350 EC(J,K)= EC(J,K)-XLE
      DO 1360 L=2,NCV
      K= NCV +2 -L
      K1= K-1
 1360 EC(J,K)= EC(J,K)-EC(J,K1)
C
 1370 CONTINUE
C
C
      DO 1390 J=1,NSPV
      J2= J+1
      DO 1380 K=1,NCV
      EC(J,K)= 0.5*(EC(J,K)+EC(J2,K))
 1380 ES(J,K)= EC(J,K)*EY(J,K)
 1390 CONTINUE
C
C
C
C   * CALCULATE AIRFOIL SECTION CAMBER *
C   * CALCULATE GEOMETRIC TWIST *
C
      DO 1580 J=1,NSPS
C
      YF= YSPAN(J)
      YA= ABS(YF)
C
      M= -1
      DO 1420 L=2,NYZ
      IF (M) 1400,1400,1420
 1400 TEST= YA - Y(L)
      IF (TEST) 1410,1410,1420
 1410 M= L
 1420 CONTINUE
      M1= M-1
      IF (M1) 1430,1430,1440
 1430 M1= 1
      M= 2
 1440 RAT= (YA-Y(M1))/(Y(M)-Y(M1))
C
      TANEPS= E(M1) + RAT*( E(M)-E(M1) )
      TANEPS= TAN(TANEPS/RAD)
      DELTAZ= Z(M1) + RAT*( Z(M)-Z(M1) )
C
      DO 1450 L=1,NCSP1
 1450 ZOCY(L)= ZOC(L,M1) + RAT*( ZOC(L,M) - ZOC(L,M1) )
C
      CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
      XROTAT= XLE + XOCREF*CW
C
C
      DO 1560 K=1,NCV
C
      N=-1
      XTEST= EV(J,K,1) - XLE
      DO 1480 L=2,NCSP1
      IF (N) 1460,1460,1480
 1460 TEST= XTEST - XOC(L)*CW
      IF (TEST) 1470,1470,1480
 1470 N= L
      N1=L-1
 1480 CONTINUE
      IF (N1) 1490,1490,1500
 1490 N1=1
      N= 2
 1500 RATS=(XTEST-CW*XOC(N1))/(XOC(N)-XOC(N1))
      EV(J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS
C
      N=-1
      XTEST= EN(J,K,1) - XLE
      DO 1530 L=2,NCSP1
      IF (N) 1510,1510,1530
 1510 TEST= XTEST - XOC(L)*CW
      IF (TEST) 1520,1520,1530
 1520 N= L
      N1= L-1
 1530 CONTINUE
      IF (N1) 1540,1540,1550
 1540 N1= 1
      N = 2
 1550 RATS= (XTEST-CW*XOC(N1))/(XOC(N)-XOC(N1))
      EN(J,K,3)= DELTAZ + CW*ZOCY(N1) + (ZOCY(N)-ZOCY(N1))*RATS
C
 1560 CONTINUE
C
C
```

```
      DO 1570 K=1,NCV
      EV(J,K,3)=  EV(J,K,3) + (EV(J,K,1)-XROTAT)*TANEPS
 1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS
C
 1580 CONTINUE
C
C
C
C   * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV
      J2= J+1
C
      DO 1630 K=1,NCV
C
      SUM1= 0.0
      SUM2= 0.0
      DO 1590 L=1,3
      M= L+3
      EN(J,K,L)=  0.5*(  EN(J2,K,L) + EN(J,K,L)   )
      RAT =       0.5*(  EV(J2,K,L) + EV(J,K,L)   )
      EV(J,K,M)=  EV(J2,K,L) - EV(J,K,L)
      EN(J,K,M)=  RAT - EN(J,K,L)
      SUM1= SUM1 + EV(J,K,M)**2
 1590 SUM2= SUM2 + EN(J,K,M)**2
      SUM1=  SQRT( SUM1 )
      SUM2=  SQRT( SUM2 )
      DO 1600 L=1,3
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1
      EN(J,K,M)=  EN(J,K,M)/SUM2
      COS1(L)=   EN(J,K,M)
 1600 COS2(L)=  -EV(J,K,M)
C
      CALL CROSP(COS1,COS2,COS3)
C
      SUM1= 0.0
      DO 1610 L=1,3
 1610 SUM1= SUM1 + COS3(L)**2
      SUM1=  SQRT( SUM1 )
      DO 1620 L=1,3
      M= L+3
 1620 EN(J,K,M)=  COS3(L)/SUM1
C
 1630 CONTINUE
C
 1640 CONTINUE
C
C
C
C   * WING DATA *
C
C     WINGD( 1)  =    SPAN
C     WINGD( 2)  =    ROOT CHORD
C     WINGD( 3)  =    TIP CHORD
C     WINGD( 4)  =    ROOT GEOMETRIC TWIST
C     WINGD( 5)  =    TIP GEOMETRIC TWIST
C     WINGD( 6)  =    AREA
C     WINGD( 7)  =    ASPECT RATIO
C     WINGD( 8)  =    MEAN CHORD
C     WINGD( 9)  =    MEAN GEOMETRIC CHORD
C     WINGD(10)  =    SPAN LOCATION OF MEAN GEOMETRIC CHORD
C     WINGD(11)  =    XMGC,  HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C     WINGD(12)  =    ZMGC,     VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C     WINGD(14)  =    SWEEP ANGLE OF 1/4 MGC
C
C
      DO 1570 K=1,NCV
      EV(J,K,3)=  EV(J,K,3) + (EV(J,K,1)-XROTAT)*TANEPS
 1570 EN(J,K,3)=  EN(J,K,3) + (EN(J,K,1)-XROTAT)*TANEPS
C
 1580 CONTINUE
C
C
C
C   * CALCULATE UNIT VECTORS *
C
      DO 1640 J=1,NSPV
      J2= J+1
C
      DO 1630 K=1,NCV
C
      SUM1= 0.0
      SUM2= 0.0
      DO 1590 L=1,3
      M= L+3
      EN(J,K,L)=  0.5*(  EN(J2,K,L) + EN(J,K,L)   )
      RAT =       0.5*(  EV(J2,K,L) + EV(J,K,L)   )
      EV(J,K,M)=  EV(J2,K,L) - EV(J,K,L)
      EN(J,K,M)=  RAT - EN(J,K,L)
      SUM1= SUM1 + EV(J,K,M)**2
 1590 SUM2= SUM2 + EN(J,K,M)**2
      SUM1=  SQRT( SUM1 )
      SUM2=  SQRT( SUM2 )
      DO 1600 L=1,3
      M= L+3
      EV(J,K,M)=  EV(J,K,M)/SUM1
      EN(J,K,M)=  EN(J,K,M)/SUM2
      COS1(L)=   EN(J,K,M)
 1600 COS2(L)=  -EV(J,K,M)
C
      CALL CROSP(COS1,COS2,COS3)
C
      SUM1= 0.0
      DO 1610 L=1,3
 1610 SUM1= SUM1 + COS3(L)**2
```

```
      SUM1=  SQRT( SUM1 )
      DO 1620 L=1,3
      M= L+3
 1620 EN(J,K,M)=  COS3(L)/SUM1
C
 1630 CONTINUE
C
 1640 CONTINUE
C
C
C
C    * WING DATA *
C
C     WINGD( 1)  =      SPAN
C     WINGD( 2)  =      ROOT CHORD
C     WINGD( 3)  =      TIP CHORD
C     WINGD( 4)  =      ROOT GEOMETRIC TWIST
C     WINGD( 5)  =      TIP GEOMETRIC TWIST
C     WINGD( 6)  =      AREA
C     WINGD( 7)  =      ASPECT RATIO
C     WINGD( 8)  =      MEAN CHORD
C     WINGD( 9)  =      MEAN GEOMETRIC CHORD
C     WINGD(10)  =      SPAN LOCATION OF MEAN GEOMETRIC CHORD
C     WINGD(11)  =      XMGC,  HORIZONTAL MOMENT ARM TO 1/4 CHORD OF MGC
C     WINGD(12)  =      ZMGC,     VERTICAL MOMENT ARM TO 1/4 CHORD OF MGC
C     WINGD(14)  =      SWEEP ANGLE OF 1/4 MGC
C     WINGD(15)  =      FLAP CHORD
C
      SUM1  = 0.0
      SUM6  = 0.0
      SUM8  = 0.0
      SUM9  = 0.0
      SUM10 = 0.0
      SUM11 = 0.0
      SUM12 = 0.0
C
      DSPAN= SPAN/200.0
C
      DO 1720 J=1,101
C
      JM= J-1
      YA2= DSPAN*FLOAT(JM)
C
      CALL CHORDT(YA2,XLE,XMGC2,XTE,XHE,CW2,CF)
C
      M=-1
      DO 1670 L=2,NY2
      IF (M) 1650,1650,1670
 1650 TEST= YA2-Y(L)-0.0001
      IF (TEST) 1660,1660,1670
 1660 M=L
      M1= L-1
 1670 CONTINUE
      IF (M1) 1680,1680,1690
 1680 M1= 1
      M = 2
 1690 RAT= (YA2-Y(M1))/(Y(M)-Y(M1))
C
      TANEPS= E(M1)+(E(M)-E(M1))*RAT
      DELTAZ= Z(M1)+(Z(M)-Z(M1))*RAT
      DELTA2= DELTAZ + (XMGC2-XLE-XOCREF*CW2)*TAN(TANEPS/RAD)
C
      IF (JM) 1710,1710,1700
C
 1700 CW  = 0.5*(CW2+CW1)
      AREA= CW*DSPAN
      SUM1  = SUM1  +  DSPAN
      SUM6  = SUM6  +  AREA
      SUM8  = SUM8  +  AREA
      SUM9  = SUM9  +  AREA*CW
      SUM10 = SUM10 +  AREA*(YA2+YA1)*0.5
      SUM11 = SUM11 + AREA*(XMGC2+XMGC1)*0.5
      SUM12 = SUM12 + AREA*(DELTA2+DELTA1)*0.5
C
 1710 DELTA1= DELTA2
      XMGC1= XMGC2
      CW1   = CW2
      YA1   = YA2
C
 1720 CONTINUE
C
C
      ZERO = 0.0
C
      CALL CHORDT(ZERO,XLE,XC04,XTE,XHE,CW,CF)
C
      XROOT= XC04
      ZROOT= Z(1)
C
      WINGD( 1) =  SUM1*2.0
      WINGD( 6) =  SUM6*2.0
      WINGD( 7) = 2.0*(SUM1**2)/SUM6
      WINGD( 8) =  SUM8/SUM1
      WINGD( 9) =  SUM9/SUM6
      WINGD(10) =  SUM10/SUM6
      WINGD(11) =  SUM11/SUM6
      WINGD(12) =  SUM12/SUM6
      WINGD(13) =  RAD*ATAN((WINGD(12)- ZROOT)/WINGD(10))
      WINGD(14) =  RAD*ATAN((WINGD(11)- XROOT)/WINGD(10))
      WINGD(15) =  FLAPC
C
C
C
      CALL PAGE
      WRITE (KOUT,1010)(WINGD(I),I=1,12),YFLAP1,YFLAP2,FLAPC,YFLAP2,BOTU
     1,FLAPC,WINGD(13),WINGD(14),IFLG(3),IFLG(2),IFLG(5),IFLG(5)
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      LINES= LINES + 15
C
C
      WRITE (KOUT,1030)
      LINES= LINES +3
C
      DO 1820 J=1,NSPS
C
      YF= YSPAN(J)
      YA= ABS(YF)
      YOB= YF/BOTU
C
      CALL CHORDT(YF,XLE,XC04,XTE,XHE,CW,CF)
C
      M= -1
      DO 1750 L=2,NY2
      IF (M) 1730,1730,1750
 1730 TEST= YA - Y(L) - 0.0001
      IF (TEST) 1740,1740,1750
 1740 M= L
      M1= M-1
 1750 CONTINUE
      IF (M1) 1760,1760,1770
 1760 M= 2
      M1= 1
 1770 RAT= (YA-Y(M1))/(Y(M)-Y(M1))
C
      ZY=  Z(M1) + RAT*( Z(M) - Z(M1) )
      EK=  E(M1) + RAT*( E(M) - E(M1) )
C
      IF (J-1) 1780,1780,1790
 1780 YF1= YF - 0.05*SPAN/FLOAT(NSPV)
      YA= ABS(YF1)
C
      CALL CHORDT(YA,XLE1,XC041,XTE1,XHE1,CW1,CF1)
      ZY1 = Z(M1) + (Z(M)-Z(M1))*(YA-Y(M1))/(Y(M)-Y(M1))
C
 1790 DELTA1= YF-YF1
C
      BETA= RAD*ATAN( (XC04-XC041)/DELTA1)
      DIHE= RAD*ATAN( (ZY-ZY1)/DELTA1 )
C
      IF (LINEX-LINES) 1800,1810,1810
 1800 CALL PAGE
      WRITE (KOUT,1030)
      LINES= LINES+2
 1810 WRITE (KOUT,1040)YOB,YF,XLE,XC04,XHE,XTE,ZY,EK,BETA,DIHE,CW,CF
C
      LINES= LINES + 1
      YF1= YF
      ZY1= ZY
      XC041= XC04
 1820 CONTINUE
C
C
      WRITE (KOUT,1000)
      LINES= LINES +3
      LINES= LINES +7
      IF (LINEX-LINES) 1830,1840,1840
 1830 CALL PAGE
      LINES= LINES +7
 1840 WRITE (KOUT,1050)(XOC(I),I=1,10)
      LINES= LINES +1
C
      DO 1870 J=1,NYS
      IF (LINEX-LINES) 1850,1860,1860
 1850 CALL PAGE
      WRITE (KOUT,1050)
      LINES= LINES+7
 1860 CONTINUE
      YOB= Y(J)/BOTU
      WRITE (KOUT,1060)Y(J),YOB,(ZOC(I,J),I=1,NCS)
      LINES= LINES + 1
 1870 CONTINUE
C
      LINES= LINES+3
      IF (LINEX-LINES) 1880,1890,1890
 1880 CALL PAGE
      LINES= LINES +3
 1890 WRITE (KOUT,1000)
C
C
C
C    * DEBUG OUTPUT *
C
      IF (IFLG(10)) 2030,1900,1900
 1900 IFLG(10)= IFLG(10)-1
C
C
      LINES= LINES+2
      IF (LINEX-LINES) 1910,1920,1920
 1910 CALL PAGE
      LINES= LINES+2
 1920 WRITE (KOUT,1070)
C
      DO 1950 K=1,NCV
      LINES= LINES+1
      DO 1940 J=1,NSPV
      LINES= LINES+1
      IF (LINEX-LINES) 1930,1940,1940
 1930 CALL PAGE
      WRITE (KOUT,1070)
      LINES= LINES +  2+1
 1940 WRITE (KOUT,1080)J,K,EN(J,K,2),EY(J,K),EC(J,K),ES(J,K)
 1950 WRITE (KOUT,1020)
C
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```
      LINES= LINES+3
      IF (LINEX-LINES) 1960,1970,1970
 1960 CALL PAGE
      LINES= LINES+3
 1970 WRITE (KOUT,1000)
C
      IF (LINEX-LINES) 1980,1990,1990
 1980 CALL PAGE
      LINES= LINES +  2
 1990 WRITE (KOUT,1090)
C
      DO 2020 K=1,NCV
      LINES= LINES+1
      DO 2010 J=1,NSPV
      LINES= LINES+1
      IF (LINEX-LINES) 2000,2010,2010
 2000 CALL PAGE
      WRITE (KOUT,1090)
      LINES= LINES +  2
 2010 WRITE (KOUT,1100)J,K,(EV(J,K,I),I=1,6),(EN(J,K,I),I=1,6)
 2020 WRITE (KOUT,1020)
C
 2030 CONTINUE
C
      LINES= LINES+3
      IF (LINEX-LINES) 2040,2050,2050
 2040 CALL PAGE
      LINES= LINES+3
 2050 WRITE (KOUT,1000)
C
C
C    * WRITE ON CALCOMPLOT TAPE *
C
      IF (IFLG(12)-1) 2460,2060,2060
 2060 IREC1=1
      IREC2=7
      XZERO = X(1) - 0.4*BOTU
      ZZERO = Z(1)
C
      DO 2070 J=1,NSPS
      YSPN = YSPAN(J)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      YSPN = YSPN/BOTU
      XLE = (XLE  -XZERO)/BOTU
      XC04= (XC04 -XZERO)/BOTU
      XTE = (XTE  -XZERO)/BOTU
      XHE = (XHE  -XZERO)/BOTU
      CW   =   CW/BOTU
      CF   =   CF/BOTU
 2070 WRITE(KT2)IREC1,IREC2,YSPN,XLE,XC04,XTE,XHE,CW,CF
C
C
      IREC1= 2
      IREC2= 2
      K=1
      DO 2100 J=1,NSPS
      YSPN = EV(J,K,2)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHF,CW,CF)
C
      YSPN = YSPN/BOTU
      XLE = (XLE    -XZERO)/BOTU
      XTE = (XTE    -XZERO)/BOTU
      IF (ITET) 2080,2080,2090
 2080 ITET = 1
      WRITE(KT2)IREC1,IREC2,YSPN,XLE
      WRITE(KT2)IREC1,IREC2,YSPN,XTE
      GO TO 2100
 2090 ITET = -1
      WRITE(KT2)IREC1,IREC2,YSPN,XTE
      WRITE(KT2)IREC1,IREC2,YSPN,XLE
 2100 CONTINUE
C
C
      IREC1= 3
      IREC2= 2
      ITET =-1
      DO 2150 K=1,NCV
      DO 2140 J=1,NSPS
      IF (ITET) 2110,2110,2120
 2110 JR= J
      GO TO 2130
 2120 JR= NSPS +1-J
 2130 CONTINUE
      YSPN = ( EV(JR,K,2) )/BOTU
      XLE = (EV(JR,K,1) -0.25*EC(JR,K) -XZERO)/BOTU
 2140 WRITE(KT2)IREC1,IREC2,YSPN,XLE
      ITET = -1*ITET
 2150 CONTINUE
C
C
      IREC1=4
      IREC2=3
C
      DO 2210 J=1,NSPS
C
      YSPN= EV(J,1,2)
      YA= ABS(YSPN)
      M=-1
      DO 2180 K=1,NY2
      IF (M) 2160,2180,2180
 2160 TEST= YA-Y(K)
      IF (TEST) 2170,2170,2180
 2170 M= K
```

```
 2180 CONTINUE
C
      M1=M-1
      IF (M1) 2190,2190,2200
 2190 M=2
      M1=1
 2200 RAT= (  YA      -Y(M1))/(Y(M)-Y(M1))
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
      TANEPS=(E(M1) + (E(M)-E(M1))*RAT)/RAD
      TANEPS= TAN(TANEPS)
      ZLE= (-DELTAZ + TANEPS*CW*(XOCREF)       )/BOTU
      ZTE= (-DELTAZ + TANEPS*CW*(XOCREF-1.0) )/BOTU
      YSPN= YSPN/BOTU
 2210 WRITE(KT2)IREC1,IREC2,YSPN,ZLE,ZTE
C
C
      IREC1= 5
      IREC2= 6
      ZERO = 0.0
      XZERO= X(1) + C(1)*(0.5-XOCREF)
      YZERO= Y(1)
      ZZERO= Z(1)
      PHIR= 45.0/RAD
      PHIP = -PHIR
      PHIQ = 0.5*PHIP
C
C
      DO 2270 J=1,NSPS
C
      YSPN = YSPAN(J)
      YA = ABS(YSPN)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      M=-1
      DO 2240 K=1,NYS
      IF (M) 2220,2240,2240
 2220 TEST=  YA-Y(K)-0.0001
      IF (TEST) 2230,2230,2240
 2230 M=K
 2240 CONTINUE
      IF (M-1) 2250,2250,2260
 2250 M= 2
 2260 M1= M-1
C
      RAT= (YA-Y(M1))/(Y(M)-Y(M1))
      DELTAZ=  Z(M1) + (Z(M)-Z(M1))*RAT
      TANEPS=  E(M1) + (E(M)-E(M1))*RAT
      TANEPS= TAN(TANEPS/RAD)
C
      ZLE =  (-DELTAZ + TANEPS*CW*( XOCREF   ) +ZZERO )/BOTU
      YLE =  YSPN/BOTU
      XLE =  ( XLE -XZERO)/BOTU
      ZTE =  (-DELTAZ + TANEPS*CW*(XOCREF-1.0)+ZZERO )/BOTU
      YTE = YLE
      XTE =  ( XTE -XZERO)/BOTU
C
      CALL ROTATE( XLE,ZLE, ZERO,ZERO, PHIR, ZERO,ZERO, XLE,ZLE  )
      CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE  )
      CALL ROTATE( YLE,ZLE, ZERO,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE  )
      CALL ROTATE( XTE,ZTE, ZERO,ZERO, PHIR, ZERO,ZERO, XTE,ZTE  )
      CALL ROTATE( YTE,XTE, ZERO,ZERO, PHIP, ZERO,ZERO, YTE,XTE  )
      CALL ROTATE( YTE,ZTE, ZERO,ZERO, PHIQ, ZERO,ZERO, YTE,ZTE  )
C
 2270 WRITE(KT2)IREC1,IREC2,YLE,ZLE,YTE,ZTE,XLE,XTE
C
C
      IREC1= 6
      IREC2= 3
      I=1
C
      DO 2350 J=1,NSPS
C
      YSPN = EV(J,I,2)
      YA = ABS(YSPN)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      M= -1
      DO 2300 K=1,NYS
      IF (M) 2280,2300,2300
 2280 TEST= YA-Y(K)-0.0001
      IF (TEST) 2290,2290,2300
 2290 M= K
 2300 CONTINUE
      IF (M-1) 2310,2310,2320
 2310 M= 2
 2320 M1= M-1
C
      RAT= (YA-Y(M1))/(Y(M)-Y(M1))
      DELTAZ= Z(M1) + (Z(M)-Z(M1))*RAT
      TANEPS= E(M1) + (E(M)-E(M1))*RAT
      TANEPS= TAN(TANEPS/RAD)
C
      ZLE =  (-DELTAZ + TANEPS*CW*(  XOCREF    ) + ZZERO )/BOTU
      YLE =  YSPN/BOTU
      XLE = ( XLE - XZERO )/BOTU
      ZTE =  (-DELTAZ + TANEPS*CW*(XOCREF-1.0 ) + ZZERO )/BOTU
      YTE =  YLE
      XTE = ( XTE - XZERO )/BOTU
C
      CALL ROTATE( XLE,ZLE, ZERO,ZERO, PHIR, ZERO,ZERO, XLE,ZLE  )
      CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE  )
```

```
      CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE  )
      CALL ROTATE( XTE,ZTE, ZERC,ZERO, PHIR, ZERO,ZERO, XTE,ZTE  )
      CALL ROTATE( YTE,XTE, ZERC,ZERO, PHIP, ZERO,ZERO, YTE,XTE  )
      CALL ROTATE( YTE,ZTE, ZERC,ZERO, PHIQ, ZERO,ZERO, YTE,ZTE  )
C
      IF (ITET) 2330,2330,2340
 2330 ITET = 1
      WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE
      WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE
      GO TO 2350
 2340 ITET = -1
      WRITE(KT2)IREC1,IREC2,YTE,ZTE,XTE
      WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE
C
 2350 CONTINUE
C
C
      IREC1= 7
      IREC2= 3
      ITET = -1
C
      DO 2450 I=1,NCVPL
      DO 2440 J=1,NSPS
C
      IF (ITET) 2360,2360,2370
 2360 JR= J
      GO TO 2380
 2370 JR= NSPS +1-J
 2380 CONTINUE
C
      YSPN=  EV(JR,I,2)
      YA = ABS(YSPN)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      M= -1
      DO 2410 K=1,NYS
      IF (M) 2390,2410,2410
 2390 TEST= YA  -Y(K)-0.0001
      IF (TEST) 2400,2410,2410
 2400 M= K
 2410 CONTINUE
      IF (M-1) 2420,2420,2430
 2420 M= 2
 2430 M1= M-1
C
      RAT= (YA-Y(M1))/(Y(M)-Y(M1))
      DELTAZ= Z(M1) + ( Z(M)-Z(M1) )*RAT
      TANEPS= E(M1) + ( E(M)-E(M1) )*RAT
      TANEPS= TAN(TANEPS/RAD)
C
      XTE = XLE
      XLE =  EV(JR,I,1) -0.25*EC(JR,I)
      YLE =  YSPN/BOTU
      ZLE = (-DELTAZ + TANEPS*( XTE + CW*XOCREF - XLE ) + ZZERO )/BOTU
      XLE =  (XLE-XZERC)/BOTU
C
      CALL ROTATE( XLE,ZLE, ZERC,ZERO, PHIR, ZERO,ZERO, XLE,ZLE  )
      CALL ROTATE( YLE,XLE, ZERO,ZERO, PHIP, ZERO,ZERO, YLE,XLE  )
      CALL ROTATE( YLE,ZLE, ZERC,ZERO, PHIQ, ZERO,ZERO, YLE,ZLE  )
C
 2440 WRITE(KT2)IREC1,IREC2,YLE,ZLE,XLE
C
      ITET= -1*ITET
C
 2450 CONTINUE
C
C
      END FILE KT2
      IFLG(15)= IFLG(15) +1
      LINES= LINES +2
      WRITE (KOUT,1130)IFLG(15)
C
C
 2460 CONTINUE
C
C
      RETURN
C     XXXXXX
C
C
      END


∇ FOR B04,B04
C
C
C
      SUBROUTINE DLIFT(ALFA,ZHEIGT)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DOUBLE PRECISION SCALE,SUP,DETERM,AMAT(71,71),VMAT(71)
      DIMENSION P(3),B(3),D(3)
      DIMENSION COS1(3),COS2(3),COS3(3)
      DIMENSION SUMWL(4),SUMSL(4)
      DIMENSION PW(3),BW(3),DW(3)
C
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2   ,LINEX ,LINES
C
      COMMON/DATA02/IFLG(15)     ,EXECK(15)    ,RAD   ,PIE
C
```

```
      COMMON/DATA05/WINGD(15)     ,EY(42,10)     ,EC(42,10)     ,ES(42,10)
     *,EYE(10)      ,ELE(10)      ,ETE(10)       ,EHE(10)       ,EG(42,10)
     *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)
C
C
 1000 FORMAT(1X)
 1010 FORMAT(1X,//,1X)
C
 1020 FORMAT(47X,28HVORTEX LATTICE MATRIX DETAIL,/,47X,28(1H*),//,1X)
 1030 FORMAT( 1X,12H  J  K NP NG,
     2 60H  VFS(MAT)  VIN(MAT)   P(X)       P(Y)       P(Z)       B(X)    ,
     3 50H   B(Y)       B(Z)      D(X)       D(Y)       D(Z)   ,/,1X)
 1040 FORMAT(1X,4I3,11E10.4)
C
 1050 FORMAT(48X,24HLIFT DISTRIBUTION DETAIL,/,48X,24(1H*),//,1X)
 1060 FORMAT(3X,4HJ  K,5X,40HP(X)       P(Y)       P(Z)       AREA      ,
     160HCPN         G(X)       G(Y)       G(Z)       VI(X)      VI(Y)     ,
     215HVI(Z)      GAMA ,      /,1X)
 1070 FORMAT( 1X, 2I3, 3F10.3, 2F10.4, 6F10.5, E10.4 )
C
 1080 FORMAT(48X,24HSECTION LIFT COEFFCIENTS,/,48X,24(1H*),//,1X)
 1090 FORMAT( 8X,3H  J,99H      2Y/B          Y           C         SCL      SCL
     1C/B      DLIFT     SCM(C/4)     1XL          LYL         1ZL  ,/,1X)
 1100 FORMAT( 8X,I3,F10.4,2F10.3,7F10.4)
C
 1110 FORMAT(///,47X,25HWING AIRLOAD COEFFICIENTS,/,47X,25(1H*),///,18X,
     2 60H     WCL        WCDI        WCMP       WCMR        WCMY        1KL  ,
     3 40H     1YL         1ZL        DELTA      SCALE ,//,
     4 3X,15HWITH LE SUCTION,  5F10.5,3F10.6, 2E10.4,/,
     5 3X,15H NO LE SUCTION ,  5F10.5,3F10.6,/,1X )
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C
C   * INITIALIZE *
C
      NSPV = IFLG(3)
      NCV  = IFLG(6)
      SPAN = WINGD(1)
      WAREA= WINGD(6)
      WMGC = WINGD(9)
      BOTU=  SPAN/2.0
C
      ALFAR= ALFA/RAD
      TANA = TAN(ALFAR)
      COSA = 1.0/SQRT(1.0+TANA**2)
      SINA = TANA*COSA
      TANV= -TAN(0.5*ALFAR)
      TANVG= -TAN(1.5*ALFAR)
      UNIT = 0.25/PIE
      UNITG= -UNIT
C
C
C   * SYMMETRIC OR UNSYMMETRIC TEST *
C
      NZERO= 1
      IF (IFLG(1)-1) 1120,1130,1130
 1120 CONTINUE
      NSPO2= NSPV/2
      NTEST= NSPV-NSPO2*2
      NZERO= NSPO2 + 1
 1130 CONTINUE
C
C
C
C   * CALCULATE MATRICES VMAT(NV) $ AMAT(NG,NV) *
C
      NV= 0
      NM= 0
      DO 1420 KV=1,NCV
      DO 1390 JV=NZERO,NSPV
      NV= NV+1
C
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= -SINA
      YSPN= EN(JV,KV,2)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      DO 1140 L=1,3
      M= L+3
      COS2(L)= EN(JV,KV,M)
 1140 P(L)= EN(JV,KV,L)
C
      CALL FLAPS(YSPN,XHE,   P,COS2)
C
      CALL DOTP(COS1,COS2,VMATDP)
C
      VMAT(NV)= VMATDP
C
C
      DO 1150 L=1,3
 1150 COS1(L)= COS2(L)
C
      NG= 0
      DO 1380 KG=1,NCV
      DO 1370 JG=NZERO,NSPV
      NG= NG+1
C
      I= JG+1
      DO 1160 L=1,3
      B(L)= EV(JG,KG,L)
```

```
 1160 D(L)= EV( I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
C
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN, XHE,D,COS2 )
      DO 1170 L=1,3
      PW(L) = P(L)
      BW(L) = B(L)
 1170 DW(L) = D(L)
C
      CALL VORTEX(P,B,D,TANV,UNIT,  VI,COS2)
      CALL DOTP(COS1,COS2,SUM1)
C
      SUM1= SUM1*VI
      SUM2= 0.0
C
      IF (IFLG(9)-1) 1190,1180,1180
 1180 CONTINUE
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM3)
C
      SUM1= SUM1 + SUM3*VI
 1190 CONTINUE
C
      IF (IFLG(1)-1) 1200,1250,1250
 1200 JGM= NSPV-JG+1
      IF (JGM-JG) 1210,1250,1250
      DO 1420 KV=1,NCV
      DO 1390 JV=NZERO,NSPV
      NV= NV+1
C
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= -SINA
      YSPN= EN(JV,KV,2)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      DO 1140 L=1,3
      M= L+3
      COS2(L)= EN(JV,KV,M)
 1140 P(L)= EN(JV,KV,L)
C
      CALL FLAPS(YSPN,XHE,   P,COS2)
C
      CALL DOTP(COS1,COS2,VMATDP)
C
      VMAT(NV)= VMATDP
C
C
      DO 1150 L=1,3
 1150 COS1(L)= COS2(L)
C
      NG= 0
      DO 1380 KG=1,NCV
      DO 1370 JG=NZERO,NSPV
      NG= NG+1
C
      I= JG+1
      DO 1160 L=1,3
      B(L)= EV(JG,KG,L)
 1160 D(L)= EV( I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN, XHE,D,COS2 )
      DO 1170 L=1,3
      PW(L) = P(L)
      BW(L) = B(L)
 1170 DW(L) = D(L)
C
      CALL VORTEX(P,B,D,TANV,UNIT,  VI,COS2)
      CALL DOTP(COS1,CCS2,SUM1)
C
      SUM1= SUM1*VI
      SUM2= 0.0
C
      IF (IFLG(9)-1) 1190,1180,1180
 1180 CONTINUE
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG, VI,COS2)
      CALL DOTP(COS1,CCS2,SUM3)
C
      SUM1= SUM1 + SUM3*VI
 1190 CONTINUE
C
      IF (IFLG(1)-1) 1200,1250,1250
 1200 JGM= NSPV-JG+1
      IF (JGM-JG) 1210,1250,1250
 1210 CONTINUE
      I = JGM+1
      DO 1220 L=1,3
      B(L) = EV(JGM,KG,L)
```

```
 1220 D(L) = EV(   I,KG,L)
C
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN, XHE,D,COS2 )
C
      CALL VORTEX(P,B,D,TANV,UNIT,  VI,COS2)
      CALL DOTP(COS1,COS2,SUM2)
C
      SUM2= SUM2*VI
C
      IF (IFLG(9)-1) 1240,1230,1230
 1230 CONTINUE
      CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG, VI,COS2)
      CALL DOTP(COS1,COS2,SUM4)
C
      SUM2= SUM2 + SUM4*VI
 1240 CONTINUE
C
 1250 CONTINUE
C
      AMAT(NG,NV)= SUM1+SUM2
C
C
      IF (EXECK(15)-1.0) 1260,1360,1360
 1260 IF (IFLG(10)-5) 1360,1270,1270
 1270 IF (NM-1) 1280,1280,1340
 1280 LINES= LINES+4
      NM= 10
      IF (LINEX-LINES) 1290,1300,1300
 1290 CALL PAGE
      LINES= LINES+4
 1300 WRITE (KOUT,1020)
 1310 LINES=LINES+2
      IF (LINEX-LINES) 1320,1330,1330
 1320 CALL PAGE
      LINES= LINES+2
 1330 WRITE (KOUT,1030)
 1340 LINES=LINES+1
      IF (LINEX-LINES) 1320,1350,1350
 1350 WRITE (KOUT,1040)JV,KV,NV,NG,VMAT(NV),AMAT(NG,NV),(PW(I),I=1,3),(B
     1W(I),I=1,3),(DW(I),I=1,3)
 1360 CONTINUE
C
C
 1370 CONTINUE
 1380 CONTINUE
C
 1390 CONTINUE
C
      IF (EXECK(15)-1.0) 1400,1420,1420
 1400 IF (IFLG(10)-5) 1420,1410,1410
 1410 WRITE (KOUT,1000)
      LINES=LINES+1
C
 1420 CONTINUE
C
C
      LINES= LINES+3
      IF (LINEX-LINES) 1430,1440,1440
 1430 CALL PAGE
      GO TO 1450
 1440 WRITE (KOUT,1010)
 1450 CONTINUE
C
C
C
C
C    * SOLVE FOR GAMA *
C
C
      NM= 0
      SUP= 0.0
      DO 1470 J=1,NV
      DO 1460 K=1,NG
      NM= NM+1
 1460 SUP= SUP + DABS( AMAT(K,J) )
 1470 CONTINUE
      SCALE = FLOAT(NM)
      SCALE =  SUP/SCALE
      DO 1490 J=1,NV
      DO 1480 K=1,NG
 1480 AMAT(J,K)= AMAT(J,K)/SCALE
 1490 CONTINUE
C
      CALL DMATIN(AMAT,NV,DETERM)
C
C
      NG= 0
      DO 1530 K=1,NCV
      DO 1520 J=NZERO,NSPV
      NG=NG+1
C
      SUP= 0.0
      NV= 0
      DO 1510 KV=1,NCV
      DO 1500 JV=NZERO,NSPV
      NV=NV+1
 1500 SUP= SUP - VMAT(NV)*AMAT(NV,NG)
 1510 CONTINUE
```

```
C
      SUP = SUP/SCALE
      SUM = -SUP
 1520 EG(J,K)= SUM/EXECK(1)
 1530 CONTINUE
C
C
C
C
      IF (IFLG(1)-1) 1540,1570,1570
 1540 CONTINUE
      DO 1560 J=NZERO,NSPV
      JM= NSPV+1-J
      DO 1550 K=1,NCV
 1550 EG(JM,K) = EG(J,K)
 1560 CONTINUE
 1570 CONTINUE
C
C
C
C    * SOLVE FOR INDUCED VELOCITY MATRIX *
C
      DO 1700 K=1,NCV
      DO 1690 J=NZERO,NSPV
C
      I = J+1
      DO 1580 L=1,3
      SUMSL(L)= 0.0
      B(L)= EV(J,K,L)
 1580 D(L)= EV(I,K,L)
      YSPN= B(2)
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
      CALL FLAPS( YSPN,XHE,B,COS3)
      YSPN= D(2)
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
      CALL FLAPS( YSPN,XHE,D,COS3)
      DO 1590 L=1,3
 1590 P(L)= 0.5*( B(L)+D(L) )
C
      DO 1660 KG=1,NCV
      DO 1650 JG=1,NSPV
C
      I = JG+1
      DO 1600 L=1,3
      B(L)= EV(JG,KG,L)
 1600 D(L)= EV( I,KG,L)
      YSPN= B(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN,XHE,B,COS2 )
      YSPN= D(2)
      CALL CHORDT( YSPN,XLE,XC04,XTE,XHE,CW,CF )
      CALL FLAPS( YSPN, XHE,D,COS2 )
C
      CALL VORTEX(P,B,D,TANV,UNIT,VI,COS2)
C
      DO 1610 L=1,3
 1610 SUMSL(L)= SUMSL(L)  - EG(JG,KG)*VI*COS2(L)
C
      IF (IFLG(9)-1) 1640,1620,1620
 1620 CALL REFLEC(B,ZHEIGT,ALFAR,COSA)
      CALL REFLEC(D,ZHEIGT,ALFAR,COSA)
C
      CALL VORTEX(P,B,D,TANVG,UNITG,VI,COS2)
C
      DO 1630 L=1,3
 1630 SUMSL(L)= SUMSL(L)  - EG(JG,KG)*VI*COS2(L)
 1640 CONTINUE
 1650 CONTINUE
 1660 CONTINUE
C
      DO 1670 L=1,3
 1670 VVINDX(J,K,L) = SUMSL(L)*EXECK(1)
      IF (NZERO-2) 1690,1680,1680
 1680 M =  NSPV +1 -J
      VVINDX(M,K,1)=  VVINDX(J,K,1)
      VVINDX(M,K,2)= -VVINDX(J,K,2)
      VVINDX(M,K,3)=  VVINDX(J,K,3)
C
 1690 CONTINUE
 1700 CONTINUE
C
C
C
C    * WING COEFFICIENTS *
C
      FACT1= 2.0/WINGD(6)
      FACT2= FACT1/WINGD(9)
      FACT3= FACT1/WINGD(1)
      WPMO= 0.0
      WRMO= 0.0
      WYMO= 0.0
      WCLV= 0.0
      WCDV= 0.0
      WPMV= 0.0
      WRMV= 0.0
      WYMV= 0.0
      NM=0
      DO 1710 L=1,4
 1710 SUMWL(L)= 0.0
C
C
      DO 1990 J=1,NSPV
C
      YSPN= EN(J,1,2)
      YA= ABS(YSPN)
      M= -1
```

```
      DO 1740 L=2,10
      IF (M) 1720,1740,1740
 1720 TEST= YA-EYE(L)
      IF (TEST) 1730,1740,1740
 1730 M= L
 1740 CONTINUE
      IF (M-2) 1750,1760,1760
 1750 M = 2
 1760 M1= M-1
C
      RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE = ELE(M1) + RATS*(ELE(M)-ELE(M1))
      XHE = EHE(M1) + RATS*(EHE(M)-EHE(M1))
      TANLE= (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))
      COSLE= SQRT(1.0+TANLE**2)
C
C
      DO 1960 K=1,NCV
      NM= NM+1
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SINA
C
      I = J+1
      DO 1770 L=1,3
      B(L)= EV(J,K,L)
      D(L)= EV(I,K,L)
 1770 P(L)= 0.5*( B(L)+D(L) )
      YSPN = B(2)
      CALL FLAPS(YSPN,XHE,B,COS3)
      YSPN = D(2)
      CALL FLAPS(YSPN,XHE,D,COS3)
      YSPN = P(2)
      SUMB = 0.0
      DO 1780 L=1,3
      COS2(L)= D(L)-B(L)
 1780 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 1790 L=1,3
 1790 COS2(L) = COS2(L)/SUMB
C
      CALL FLAPS( YSPN,XHE, P,COS3 )
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= (EY(J,K)/COS2(2))*EG(J,K)
C
      DO 1800 L=1,3
 1800 SUMSL(L)= SLIFT*COS3(L)
C
      XARM = P(1) - WINGD(11)
      YARM = P(2)
      ZARM = P(3) - WINGD(12)
      WPMO = WPMO + ( XARM*SUMSL(3) + ZARM*SUMSL(1) )*EXECK(13)
      WRMO = WRMO - ( YARM*SUMSL(3) + ZARM*SUMSL(2) )
      WYMO = WYMO - ( YARM*SUMSL(1) - XARM*SUMSL(2) )
      SCTS = -SUMSL(1)
      IF (SCTS) 1810,1810,1820
 1810 SCTS = 0.0
 1820 SNFC = COSLE*SCTS
      IF (SUMSL(3)) 1830,1840,1840
 1830 SNFC = -SNFC
 1840 CONTINUE
      WCLV= WCLV + SNFC
      WCDV= WCDV + SCTS
      XARM = XLE - WINGD(11)
      WPMV = WPMV + ( XARM*SNFC + ZARM*SCTS )
      WRMV = WRMV - ( YARM*SNFC )
      WYMV = WYMV - ( YARM*SCTS )
C
      DO 1850 L=1,3
 1850 SUMWL(L)= SUMWL(L) + SUMSL(L)
C
C
      IF (EXECK(15)-1.0) 1860,1950,1950
 1860 IF (IFLG(10)-2) 1950,1870,1870
 1870 IF (NM-1) 1880,1880,1930
 1880 LINES= LINES+4
      IF (LINEX-LINES) 1890,1900,1900
 1890 CALL PAGE
      LINES= LINES+4
 1900 WRITE (KOUT,1050)
      LINES= LINES+2
      IF (LINEX-LINES) 1910,1920,1920
 1910 CALL PAGE
      LINES= LINES+2
 1920 WRITE (KOUT,1060)
 1930 LINES= LINES+1
      IF (LINEX-LINES) 1910,1940,1940
 1940 CPLIFT= -2.0*SUMSL(3)/ES(J,K)
      WRITE (KOUT,1070)J,K,(P(I),I=1,3),ES(J,K),CPLIFT,(COS3(I),I=1,3),(
     1VVINDX(J,K,I),I=1,3),EG(J,K)
 1950 CONTINUE
C
C
 1960 CONTINUE
C
      IF (EXECK(15)-1.0) 1970,1990,1990
 1970 IF (IFLG(10)-2) 1990,1980,1980
 1980 WRITE (KOUT,1000)
      LINES=LINES+1
 1990 CONTINUE
C
      SUMWL(4)= 0.0
      DO 2000 L=1,3
```

```
 2000 SUMWL(4)= SUMWL(4) + SUMWL(L)**2
      SUMWL(4)= SQRT(SUMWL(4))
      DO 2010 L=1,3
 2010 SUMWL(L)= SUMWL(L)/SUMWL(4)
C
      WCL =-FACT1*SUMWL(4)*(SUMWL(3)*COSA+SUMWL(1)*SINA)
      WCD= FACT1*SUMWL(4)*(SUMWL(1)*COSA-SUMWL(3)*SINA)
      WPMO= WPMO*FACT2
      WRMO= WRMO*FACT3
      WYMO= WYMO*FACT3
      SNFC= FACT1*(  WCLV*COSA + WCDV*SINA  )
      SCTS= FACT1*(  WCDV*COSA - WCLV*SINA  )
      WPMV = WPMO + FACT2*WPMV
      WRMV= WRMO + FACT3*WRMV
      WYMV= WYMO + FACT3*WYMV
      WCLV= WCL - SNFC
      WCDV= WCD + SCTS
C
      IF (EXECK(15)-1.C) 2020,2050,2050
 2020 LINES= LINES+3
      IF (LINEX-LINES) 2030,2040,2040
 2030 CALL PAGE
      GO TO 2050
 2040 WRITE (KOUT,1010)
 2050 CONTINUE
C
      EXECK(2)= WCL
      EXECK(3)= WPMO
      EXECK(4)= WRMO
      EXECK(5)= WYMO
      EXECK(6)=(WCLV-WCL)
      EXECK(7)=(WPMV-WPMO)
      EXECK(8)=(WCDV-WCD)
      EXECK(9)= WCD
C
      IF (EXECK(15)-1.C) 2060,2250,2250
 2060 CONTINUE
C
C
C
C   * SECTION COEFFICIENTS *
C
      NJ= 0
C
      DO 2220 J=NZERO,KSPV
C
      NJ=NJ+1
C
      SPMO= 0.0
      YSPN= EN(J,1,2)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      CORD= CW**2
C
      DO 2070 L=1,4
 2070 SUMSL(L)= 0.0
C
      DO 2120 K=1,NCV
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SINA
C
      I = J+1
      DO 2080 L=1,3
      B(L)= EV(J,K,L)
      D(L)= EV(I,K,L)
 2080 P(L)= 0.5*( B(L)+D(L) )
      YSPN = B(2)
      CALL FLAPS(YSPN,XHE,B,COS3)
      YSPN = D(2)
      CALL FLAPS(YSPN,XHE,D,COS3)
      YSPN = P(2)
      SUMB = C.0
      DO 2090 L=1,3
      COS2(L)= D(L)-B(L)
 2090 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 2100 L=1,3
 2100 COS2(L) =  COS2(L)/SUMB
      CALL FLAPS(YSPN,XHE,P,COS3)
C
      CALL CROSP(COS1,COS2,COS3)
C
      SLIFT= EG(J,K)/COS2(2)
C
      DO 2110 L=1,3
 2110 SUMSL(L)= SUMSL(L) + SLIFT*COS3(L)
C
      XARM= EV(J,K,1) + 0.5*EY(J,K)*EV(J,K,4)/EV(J,K,5) -XC04
      SPMO= SPMO + SLIFT*COS3(3)*XARM
C
 2120 CONTINUE
C
      DO 2130 L=1,3
 2130 SUMSL(4)= SUMSL(4) + SUMSL(L)**2
      SUMSL(4)= SQRT(SUMSL(4))
      DO 2140 L=1,3
 2140 SUMSL(L)= SUMSL(L)/SUMSL(4)
C
      SCL=  SUMSL(4)*2.0/CW
      SPMO= SPMO*2.0/CORD
C
      IF (NJ-1) 2150,2150,2200
 2150 LINES= LINES+4
```

```
      IF (LINEX-LINES) 2160,2170,2170                                   B04 6580
 2160 CALL PAGE                                                         B04 6590
      LINES= LINES+4                                                    B04 6600
 2170 WRITE (KOUT,1080)                                                 B04 6610
      LINES=LINES+2                                                     B04 6620
      IF (LINEX-LINES) 2180,2190,2190                                   B04 6630
 2180 CALL PAGE                                                         B04 6640
      LINES= LINES+2                                                    B04 6650
 2190 WRITE (KOUT,1090)                                                 B04 6660
 2200 LINES= LINES+1                                                    B04 6670
      IF (LINEX-LINES) 2180,2210,2210                                   B04 6680
 2210 YOB=  EN(J,1,2)/BOTU                                              B04 6690
      SPL = 0.5*SCL*CW/BOTU                                             B04 6700
      SLIFT= SCL*CW*EY(J,1)/WINGD(6)                                    B04 6710
      WRITE (KOUT,1100)J,YOB,EN(J,1,2),CW,SCL,SPL,SLIFT,SPMO,(SUMSL(I),IB04 6720
     1=1,3)                                                             B04 6730
C                                                                       B04 6740
 2220 CONTINUE                                                          B04 6750
C                                                                       B04 6760
C                                                                       B04 6770
      CALL  INTERP(ALFA,ZHEIGT,WCL,WCD)                                 B04 6780
C                                                                       B04 6790
C                                                                       B04 6800
      RATS= SQRT( WCDV**2 + WCLV**2 )                                   B04 6810
      COS3(1)= ( WCDV*COSA - WCLV*SINA )/RATS                           B04 6820
      COS3(2)= 0.0                                                      B04 6830
      COS3(3)= (-WCLV*COSA - WCDV*SINA )/RATS                           B04 6840
C                                                                       B04 6850
      LINES=LINES+11                                                    B04 6860
      IF (LINEX-LINES) 2230,2240,2240                                   B04 6870
 2230 CALL PAGE                                                         B04 6880
      LINES= LINES +11                                                  B04 6890
 2240 WRITE (KOUT,1110)WCL,WCD,WPMO,WRMO,WYMO,(SUMWL(I),I=1,3),DETERM,SCB04 6900
     1ALE,WCLV,WCDV,WPMV,WRMV,WYMV,(COS3(I),I=1,3)                      B04 6910
      LINES=LINES+10                                                    B04 6920
C                                                                       B04 6930
C                                                                       B04 6940
 2250 RETURN                                                            B04 6950
C     XXXXXX                                                            B04 6960
C                                                                       B04 6970
C                                                                       B04 6980
      END                                                               B04 6990
```

```
V FOR B05,B05                                                           B05   10
C                                                                       B05   20
C                                                                       B05   30
C                                                                       B05   40
      SUBROUTINE  INTERP(ALFA,ZHEIGT,WCLCF,WCDCF)                       B05   50
C                                                                       B05   60
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *B05   70
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *B05   80
C                                                                       B05   90
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB05  100
C                                                                       B05  110
      DIMENSION XFUN(11), CPFUN(31)                                     B05  120
      DIMENSION YSPAN(22), XCORD(22), SPRES(22)                         B05  130
      DIMENSION SLIFT(22),SDRAG(22),CMOMT(22)                           B05  140
      DIMENSION ALIFT(42),ADRAG(42),AMOMT(42)                           B05  150
      DIMENSION FLAPN(22),FLAPX(22),AFLPN(42),AFLPX(42)                 B05  160
      DIMENSION SCLV(22),SPMV(22),SCDV(22),ACLV(42),APMV(42),ACDV(42)   B05  170
C                                                                       B05  180
      DIMENSION COS1(3),COS2(3),COS3(3)                                 B05  190
      DIMENSION SUMSL(4),B(3),D(3),P(3)                                 B05  200
C                                                                       B05  210
      COMMON/DATA01/KIN   ,KOUT   ,KT1    ,KT2    ,LINEX ,LINES         B05  220
      COMMON/DATA02/IFLG(15)      ,EXECK(15)      ,RAD    ,PIE          B05  230
      COMMON/DATA05/WINGD(15)     ,EY(42,10)      ,EC(42,10)     ,ES(42,10) B05  240
     *,EYE(10)       ,ELE(10)       ,ETE(10)       ,EHE(10)       ,EG(42,10) B05  250
     *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)                        B05  260
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2   B05  270
     *              ,NOFLAP,NOAILR                                      B05  280
C                                                                       B05  290
      DATA XFUN/ 0.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0/           B05  300
C                                                                       B05  310
C                                                                       B05  320
 1000 FORMAT(1X)                                                        B05  330
 1010 FORMAT(1X,//,1X)                                                  B05  340
C                                                                       B05  350
 1020 FORMAT(41X,38HCHORDWISE PRESSURE DISTRIBUTION DETAIL,/,41X,38(1H*)B05  360
     1,//,19X,19(2H* ),23HCHORD STATION (X-XLE)/C,19(2H *),//,19X,      B05  370
     2 11F9.5,//,19H      2Y/B       SCL ,18(2H* ),29HCHORD PRESSURE (CPL B05  380
     3-CPU)*12L,17(2H *),/,1X )                                         B05  390
 1030 FORMAT(1X,13F9.5 )                                                B05  400
C                                                                       B05  410
 1040 FORMAT(41X,41HSPANWISE SECTION LIFT DISTRIBUTION DETAIL,/,41X,41(1B05  420
     1H*),//,33X,15HWITH LE SUCTION,16X,13HNO LE SUCTION,17X,12HFLAP/AILB05  430
     2ERON,//,5X,20H         Y          2Y/B  ,2(30H      SCL       SCDI   SCM(B05  440
     3C/4)),       30H      FCN         FCX         FCH   ,/,1X)        B05  450
 1050 FORMAT(5X,F10.3,10F10.6 )                                         B05  460
C                                                                       B05  470
 1060 FORMAT(1X,/,1X,14H(EOF PLOT FILE,I3,1H)   )                       B05  480
C                                                                       B05  490
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXB05  500
C                                                                       B05  510
C                                                                       B05  520
C                                                                       B05  530
C                                                                       B05  540
C   * INITIALIZE *                                                      B05  550
C                                                                       B05  560
      IF (IFLG(11)-1) 1630,1070,1070                                    B05  570
 1070 CONTINUE                                                          B05  580
C                                                                       B05  590
      ZERO = 0.0                                                        B05  600
      ZERO1= 0.0                                                        B05  610
```

```
      ZERO2= 0.0
C
      NO= 0
      N1= 1
      N2= 2
      NSPV = IFLG(3)
      NCV  = IFLG(6)
C
      IREC4 = 1
      IWORD1= 2
      IWORD2= 10
C
      SPAN = WINGD(1)
      WAREA= WINGD(6)
      WMGC = WINGD(9)
      BOTU = SPAN/2.0
C
      BETAM= EXECK(1)
      WCL  = EXECK(2)
      WPMO = EXECK(3)
      WRMO = EXECK(4)
      WYMO = EXECK(5)
C
      FACT1= 2.0/WINGD(6)
      FACT2= FACT1/WINGD(9)
      FACT3= FACT1/WINGD(1)
C
      ALFAR= ALFA/RAD
      TANA = TAN(ALFAR)
      COSA = 1.0/SQRT(1.0+TANA**2)
      SINA = TANA*COSA
C
      NZERO= 1
      IF (IFLG(1)-1) 1080,1090,1090
 1080 CONTINUE
      NSPO2= NSPV/2
      NTEST= NSPV-NSPO2*2
      NZERO= NSPO2 + 1
 1090 CONTINUE
C
      LINES= LINES +3
      IF (LINEX-LINES) 1100,1110,1110
 1100 CALL PAGE
      LINES= LINES +3
 1110 WRITE (KOUT,1010)
C
C
C
C   * SECTION COEFFICIENTS *
C
      NJ= 0
C
C
      NSPAN = 0
C
C
      DO 1390 J=NZERO,NSPV
C
      J2= J+1
      NJ =NJ+1
      NSPAN = NSPAN+1
C
      YSPN= EN(J,1,2)
C
      YA= ABS(YSPN)
      M= -1
      DO 1140 L=2,10
      IF (M) 1120,1140,1140
 1120 TEST= YA-EYE(L)
      IF (TEST) 1130,1130,1140
 1130 M= L
 1140 CONTINUE
      IF (M-2) 1150,1160,1160
 1150 M= 2
 1160 M1= M-1
C
      RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE = ELE(M1) + RATS*( ELE(M)-ELE(M1) )
      XTE = ETE(M1) + RATS*( ETE(M)-ETE(M1) )
      XHE = EHE(M1) + RATS*( EHE(M)-EHE(M1) )
      CW   = XTE-XLE
      CF   = XTE-XHE
      XC04= XLE + CW*0.25
      TANLE = (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))
      COSLE = SQRT(1.0 + TANLE**2)
C
      CORD= CW**2
C
C
C   * SECTION LIFT LOOP *
C
      NX = 0
C
      SPMO= 0.0
C
      DO 1170 L=1,4
 1170 SUMSL(L)= 0.0
C
      DO 1220 K=1,NCV
C
      NX= NX+1
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SINA
C
```

```
      I = J+1                                                          805 1680
      DO 1180 L=1,3                                                    805 1690
      B(L)= EV(J,K,L)                                                  805 1700
      D(L)= EV(I,K,L)                                                  805 1710
 1180 P(L)= 0.5*( B(L)+D(L) )                                          805 1720
      YSPN = B(2)                                                      805 1730
      CALL FLAPS(YSPN,XHE,B,COS3)                                      805 1740
      YSPN = D(2)                                                      805 1750
      CALL FLAPS(YSPN,XHE,D,COS3)                                      805 1760
      YSPN = P(2)                                                      805 1770
      SUM8 = 0.0                                                       805 1780
      DO 1190 L=1,3                                                    805 1790
      COS2(L)= D(L)-B(L)                                               805 1800
 1190 SUM8 = SUM8 + COS2(L)**2                                         805 1810
      SUM8 = SQRT(SUM8)                                                805 1820
      DO 1200 L=1,3                                                    805 1830
 1200 COS2(L) =  COS2(L)/SUM8                                          805 1840
C                                                                      805 1850
      CALL FLAPS(YSPN,XHE,P,COS3)                                      805 1860
C                                                                      805 1870
      CALL CROSP(COS1,COS2,COS3)                                       805 1880
C                                                                      805 1890
      ZLIFT= EG(J,K)/COS2(2)                                           805 1900
C                                                                      805 1910
      SPRES(NX)= 2.0*ZLIFT*COS3(3)/EC(J,K)                             805 1920
      XCORD(NX)= (P(1)-XLE)/CW                                         805 1930
C                                                                      805 1940
      DO 1210 L=1,3                                                    805 1950
 1210 SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)                               805 1960
C                                                                      805 1970
      XARM= P(1)-XC04                                                  805 1980
      SPMO= SPMO + ZLIFT*COS3(3)*XARM                                  805 1990
C                                                                      805 2000
 1220 CONTINUE                                                         805 2010
C                                                                      805 2020
C                                                                      805 2030
      FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)                      805 2040
      FLAPX(NSPAN) =  2.0*ZLIFT*COS3(1)/EC(J,NCV)                      805 2050
C                                                                      805 2060
      DO 1230 L=1,3                                                    805 2070
 1230 SUMSL(4)= SUMSL(4) + SUMSL(L)**2                                 805 2080
      SUMSL(4)= SQRT(SUMSL(4))                                         805 2090
      DO 1240 L=1,3                                                    805 2100
 1240 SUMSL(L)= SUMSL(L)/SUMSL(4)                                      805 2110
      SUMSL(4)=  2.0*SUMSL(4)/CW                                       805 2120
C                                                                      805 2130
C                                                                      805 2140
      NX= NX+1                                                         805 2150
      SPRES(NX)= 0.0                                                   805 2160
      XCORD(NX)= 1.0                                                   805 2170
C                                                                      805 2180
      CALL CURFIT(XCORD,SPRES,ALIFT,  NX,ZERO1,ZERO2,N2,N2)            805 2190
C                                                                      805 2200
      YSPAN(NSPAN)= YSPN/BOTU                                          805 2210
      SLIFT(NSPAN)=-SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)           805 2220
      SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)           805 2230
      CMOMT(NSPAN)= 2.0*SPMO/CORD                                      805 2240
      SCTS = -SUMSL(4)*SUMSL(1)                                        805 2250
      IF (SCTS) 1250,1250,1260                                         805 2260
 1250 SCTS = 0.0                                                       805 2270
 1260 SNFC = COSLE*SCTS                                                805 2280
      IF (SUMSL(3)) 1270,1280,1280                                     805 2290
 1270 SNFC= -SNFC                                                      805 2300
 1280 CONTINUE                                                         805 2310
      SCLV(NSPAN) =  SLIFT(NSPAN) - SNFC*COSA - SCTS*SINA              805 2320
      SCDV(NSPAN) =  SDRAG(NSPAN) +SCTS*COSA - SNFC*SINA               805 2330
      SPMV(NSPAN) = CMOMT(NSPAN) - SNFC*(XC04-XLE)/CW                  805 2340
C                                                                      805 2350
C                                                                      805 2360
C                                                                      805 2370
      DXARG= XCORD(NX)/30.0                                            805 2380
C                                                                      805 2390
      DO 1300 K=1,31                                                   805 2400
C                                                                      805 2410
      XARG =  DXARG*FLOAT(K-1)                                         805 2420
      YARG = 0.0                                                       805 2430
C                                                                      805 2440
      IF (K-1) 1300,1300,1290                                          805 2450
 1290 CONTINUE                                                         805 2460
C                                                                      805 2470
C                                                                      805 2480
      CALL CURVE(XCORD,SPRES,ALIFT, XARG,YARG,DUMYK,NX,N1)             805 2490
C                                                                      805 2500
 1300 CPFUN(K)= -YARG                                                  805 2510
C                                                                      805 2520
C                                                                      805 2530
      IF (J-NZERO) 1310,1310,1340                                      805 2540
 1310 LINES= LINES + 9                                                 805 2550
      IF (LINEX-LINES) 1320,1330,1330                                  805 2560
 1320 CALL PAGE                                                        805 2570
      LINES= LINES +9                                                  805 2580
 1330 WRITE (KOUT,1020)(XFUN(I),I=1,11)                                805 2590
 1340 IF (LINEX-LINES) 1320,1350,1350                                  805 2600
 1350 LINES= LINES+1                                                   805 2610
      WRITE (KOUT,1030)YSPAN(NSPAN),SLIFT(NSPAN),(CPFUN(I),I=1,31,3)   805 2620
C                                                                      805 2630
C                                                                      805 2640
      IF (IFLG(13)-1) 1390,1360,1360                                   805 2650
 1360 CONTINUE                                                         805 2660
C                                                                      805 2670
      DO 1370 K=1,31                                                   805 2680
      XARG = DXARG*FLOAT(K-1)                                          805 2690
 1370 WRITE(KT2)IREC4,IWORD1,XARG,CPFUN(K)                             805 2700
      IREC4 = IREC4 + 1                                                805 2710
      IF (J-NSPV) 1390,1380,1380                                       805 2720
 1380 END FILE KT2                                                     805 2730
```

```
      IREC4= 1
      LINES= LINES +2
      IFLG(15)= IFLG(15) +1
      WRITE (KOUT,1060)IFLG(15)
C
C
 1390 CONTINUE
C
C
      LINES= LINES+3
      IF (LINEX-LINES) 1400,1410,1410
 1400 CALL PAGE
      LINES= LINES+3
      GO TO 1420
 1410 WRITE (KOUT,1010)
 1420 CONTINUE
C
C
C
      CALL CURFIT(YSPAN, SLIFT,ALIFT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SDRAG,ADRAG, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, CMOMT,AMOMT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPN,AFLPN, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPX,AFLPX, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCLV, ACLV,  NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCDV, ACDV,  NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SPMV, APMV,  NSPAN,ZERO1,ZERO2,N2,N2)
C
C
C
      DELTAB = 1.0/20.0
      WCLCF = 0.0
      WCDCF = 0.0
      SUMSS = 0.0
C
      DO 1580 J=1,41
C
      YOB= DELTAB*FLOAT(J-1) - 1.0
      YOBO= YOB
      YSPN= YOBO*BOTU
C
      IF (NZERO-1) 1440,1440,1430
 1430 YOB= ABS(YOB)
 1440 CONTINUE
C
      CL  = 0.0
      CD  = 0.0
      CM  = 0.0
      CLV = 0.0
      CDV = 0.0
      CPV = 0.0
      FCN = 0.0
      FCX = 0.0
C
      TEST= ABS(YOB) - 0.999
      IF (TEST) 1450,1460,1460
 1450 CONTINUE
C
      CALL CURVE(YSPAN,SLIFT,ALIFT, YOB,CL, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SDRAG,ADRAG, YOB,CD, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,CMOMT,AMOMT, YOB,CM, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPN,AFLPN, YOB,FCN,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPX,AFLPX, YOB,FCX,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN, SCLV, ACLV, YOB,CLV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN, SCDV, ACDV, YOB,CDV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN, SPMV, APMV, YOB,CPV,DUMYK,NSPAN,N1)
C
 1460 CONTINUE
C
      CALL CHOROT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      FCM = -FCN/4.0
C
      CLC1 = CL*CW
      CDC1 = CD*CW
      CWC1 = CW
C
      IF (J-1) 1480,1480,1470
 1470 WCLCF =  WCLCF + DELTAB*(CLC1+CLC2)
      WCDCF =  WCDCF + DELTAB*(CDC1+CDC2)
      SUMSS =  SUMSS + DELTAB*(CWC1+CWC2)
 1480 CLC2 =  CLC1
      CDC2 =  CDC1
      CWC2 =  CWC1
C
C
C
      IF (J-1) 1490,1450,1520
 1490 LINES= LINES+7
      IF (LINEX-LINES) 1500,1510,1510
 1500 CALL PAGE
      LINES= LINES+7
 1510 WRITE (KOUT,1040)
 1520 IF (LINEX-LINES) 1500,1530,1530
 1530 LINES= LINES +1
      NOFLPX= NOFLAP + NOAILR
      IF (NOFLPX) 1540,1540,1550
 1540 WRITE (KOUT,1050)YSPN,YOBO,CL,CD,CM,CLV,CDV,CPV
      GO TO 1560
 1550 WRITE (KOUT,1050)YSPN,YOBO,CL,CD,CM,CLV,CDV,CPV,FCN,FCX,FCM
 1560 CONTINUE
C
      IF (IFLG(14)-1) 1580,1570,1570
 1570 WRITE(KT2)IREC4,IWORD2,YOBO,CL,CD,CM,FCN,FCX,FCM,CLV,CDV,CPV
C
C
```


ORIGINAL PAGE IS
OF POOR QUALITY

```
 1580 CONTINUE
C
C
      WCLCF = WCL
      WCOCF =  WCDCF/SUMSS
C
C
      LINES= LINES+3
      IF (LINEX-LINES) 1590,1600,1600
 1590 CALL PAGE
      LINES= LINES+3
 1600 WRITE (KOUT,1010)
C
      IF (IFLG(14)-1) 1620,1610,1610
 1610 END FILE KT2
      LINES= LINES +2
      IFLG(15)= IFLG(15) +1
      WRITE (KOUT,1060)IFLG(15)
 1620 CONTINUE
C
C
C
 1630 RETURN
C     XXXXXX
C
C
      END


V FOR 806,806
C
C
C
      SUBROUTINE OLINER(ALFA,ZHEIGT,ALFAL,WINGCL,NJOBL)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION  YSPAN(22)
      DIMENSION ALFAL(20), WINGCL(21)
      DIMENSION CLA1(32),CLB(32),RCL(2,32),RCM(2,32),RYSPAN(32)
      DIMENSION SCLV(22),SPMV(22),SCDV(22),ACLV(42),APMV(42),ACDV(42)
      DIMENSION RCD(2,32),RCLV(2,32),RCDV(2,32),RPMV(2,32)
      DIMENSION WCLVS(2),WCDVS(2),WCPVS(2),   WCPOS(2),WCDIS(2)
      DIMENSION SLIFT(22),SDRAG(22),CMOMT(22)
      DIMENSION ALIFT(42),ADRAG(42),AMOMT(42)
      DIMENSION FLAPN(22),FLAPX(22),AFLPN(42),AFLPX(42)
      DIMENSION RCFL(2,32), RCFD(2,32)
C
      DIMENSION COS1(3),COS2(3),COS3(3)
      DIMENSION SUMSL(4),B(3),D(3),P(3)
      DIMENSION WCD3(3),WCL3(3),WCL4(3)
C
      COMMON/DATA01/KIN   ,KOUT   ,KT1    ,KT2    ,LINEX ,LINES
      COMMON/DATA02/IFLG(15)      ,EXECK(15)      ,RAD    ,PIE
      COMMON/DATA05/WINGD(15)     ,EY(42,10)      ,EC(42,10)     ,ES(42,10)
     *,EYE(10)       ,ELE(10)     ,ETE(10)        ,EHE(10)       ,EG(42,10)
     *,EN(42,10,6) ,EV(42,10,6) ,VVINDX(42,10,3)
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2
     *              ,NOFLAP,NOAILR
      COMMON/DATA07/LFLAP,LDRAG
C
C
C
 1000 FORMAT(1X)
 1010 FORMAT(1X,//,1X)
C
 1020 FORMAT(42X,35HLINEARIZED SOLUTION WITH LE SUCTION/42X35(1H*)//25X,
     1 60H      ALFA      ALFARO        WCL          WCL        CMP        CMR ,
     2 10H       CMY ,/,45X,40H                    SLOPE        SLOPE       SLOPE//
     3,25X,2F10.3,F10.4,4F10.5,///,1X)
C
 1030 FORMAT(30X,50H        Y            2Y/B         SCLA1         SCLB         SCL   ,
     1 10H  SCM(1/4),/,1X )
C
 1040 FORMAT(30X, F10.3, 5F10.5 )
C
 1050 FORMAT(34X,15HWITH LE SUCTION,16X,13HNO LE SUCTION,17X,12HFLAP/AIL
     1ERON,//,5X,20H         Y            2Y/B   ,2(30H        SCL            SCDI    SCM(
     2C/4)),        30H        FCN           FCX           FCH   ,/,1X)
 1060 FORMAT(5X,F10.3,10F10.6)
C
 1070 FORMAT(1X,/,17X,18HWITH LE SUCTION     ,4HWCL=,F10.5,8H / WCDI=,F10.
     15,12H / WCM(C/4)=,F10.5, 7H / L/D=,F10.5,/,18X,13HNO LE SUCTION,4X
     2, 4X,F10.5,2H /,6X,F10.5,2H /,10X,F10.5,2H /,5X,F10.5 )
C
 1080 FORMAT(41X,37HLINEARIZED SOLUTION WING COEFFICIENTS,/,41X,37(1H*),
     1 //,44X,15HWITH LE SUCTION,17X,13HNO LE SUCTION,//,
     2 30X,5HALFA , 2(30H      WCL          WCD        WCM(C/4)),/,1X)
 1090 FORMAT( 25X, F10.3, 6F10.4 )
C
 1100 FORMAT(1X,/,1X,14H(EOF PLOT FILE,I3,1H)   )
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C
C    * INITIALIZE *
C
       N0= 0
       N1= 1
       N2= 2
```

```
      NSPV = IFLG(3)
      NCV  = IFLG(6)
      NCLFLG= 1
C
      ZERO = 0.0
      ZERO1= 0.0
      ZERO2= 0.0
C
      SPAN = WINGD(1)
      WAREA= WINGD(6)
      WMGC = WINGD(9)
      BOTU = SPAN/2.0
C
      FACT1= 2.0/WINGD(4)
      FACT2= FACT1/WINGD(9)
      FACT3= FACT1/WINGD(1)
      SKINFC= EXECK(10)*2.0
      DELALF= EXECK(12)
      EXECK(15) = 2.0
C
      NZERO= 1
      IF (IFLG(1)-1) 1110,1120,1120
 1110 CONTINUE
      NSPO2= NSPV/2
      NTEST= NSPV-NSPO2*2
      NZERO= NSPO2 + 1
 1120 CONTINUE
C
C
C
C
C   * LINEARIZED LIFT TWO PASS LOOP *
C
      DO 1420 NCLC=1,2
C
      IF (NCLFLG) 1130,1140,1140
 1130 ALFA= ALFA + DELALF
C
      CALL DLIFT( ALFA,ZHEIGT)
C
      GO TO 1150
 1140 NCLFLG= -1
C
      BETAM= EXECK(1)
      WCL  = EXECK(2)
      WPMO = EXECK(3)
      WRMO = EXECK(4)
      WYMO = EXECK(5)
C
 1150 CONTINUE
C
C
      ALFAR= ALFA/RAD
      TANA = TAN(ALFAR)
      COSA = 1.0/SQRT(1.0+TANA**2)
      SINA = TANA*COSA
      WCPOS(NCLC)= EXECK(3)
      WCLVS(NCLC)= EXECK(6)
      WCDVS(NCLC)= EXECK(8)
      WCPVS(NCLC)= EXECK(7)
      WCDIS(NCLC)= EXECK(9)
C
C
C
C
C   * SECTION COEFFICIENTS *
C
      NJ= 0
C
C
      NSPAN = 0
C
C
      DO 1330 J=NZERO,NSPV
C
      J2= J+1
      NJ=NJ+1
      NSPAN = NSPAN+1
C
      YSPN= FN(J,1,2)
C
      YA= ABS(YSPN)
      M = -1
C
      DO 1180 L=2,10
      IF (M) 1160,1180,1180
 1160 TEST= YA-EYE(L)
      IF (TEST) 1170,1170,1180
 1170 M= L
 1180 CONTINUE
      IF (M-2) 1190,1200,1200
 1190 M= 2
 1200 M1= M-1
C
      RATS= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE =  ELE(M1) + RATS*( ELE(M)-ELE(M1) )
      XTE =  ETE(M1) + RATS*( ETE(M)-ETE(M1) )
      XHE =  EHE(M1) + RATS*( EHE(M)-EHE(M1) )
      CW  =  XTE-XLE
      CF  =  XTE-XHE
      XC04=  XLE + CW*0.25
      TANLE = (ELE(M)-ELE(M1))/(EYE(M)-EYE(M1))
      COSLE = SQRT(1.0+TANLE**2)
C
      CORD= CW**2
C
```

```
C
C    * SECTION LIFT LOOP *
C
C
      SPMO= 0.0
C
      DO 1210 L=1,4
 1210 SUMSL(L)= 0.0
C
      DO 1260 K=1,NCV
C
C
      COS1(1)= VVINDX(J,K,1) + COSA
      COS1(2)= VVINDX(J,K,2)
      COS1(3)= VVINDX(J,K,3) - SINA
C
      I = J+1
      DO 1220 L=1,3
      B(L)= EV(J,K,L)
      D(L)= EV(I,K,L)
 1220 P(L)= 0.5*( B(L)+D(L) )
      YSPN = B(2)
      CALL FLAPS(YSPN,XHE,B,COS3)
      YSPN = D(2)
      CALL FLAPS(YSPN,XHE,D,COS3)
      YSPN = P(2)
      SUMB = 0.0
      DO 1230 L=1,3
      COS2(L)= D(L)-B(L)
 1230 SUMB = SUMB + COS2(L)**2
      SUMB = SQRT(SUMB)
      DO 1240 L=1,3
 1240 COS2(L) =  COS2(L)/SUMB
C
      CALL FLAPS(YSPN,XHE,P,COS3)
C
      CALL CROSP(COS1,COS2,COS3)
C
      ZLIFT= FG(J,K)
C
      DO 1250 L=1,3
 1250 SUMSL(L)= SUMSL(L) + ZLIFT*COS3(L)
C
      XARM= P(1)-XCO4
      SPMO= SPMO + ZLIFT*COS3(3)*XARM
C
 1260 CONTINUE
C
C
      FLAPN(NSPAN) = -2.0*ZLIFT*COS3(3)/EC(J,NCV)
      FLAPX(NSPAN) =  2.0*ZLIFT*COS3(1)/EC(J,NCV)
C
      DO 1270 L=1,3
 1270 SUMSL(4)= SUMSL(4) + SUMSL(L)**2
      SUMSL(4)= SQRT(SUMSL(4))
      DO 1280 L=1,3
 1280 SUMSL(L)= SUMSL(L)/SUMSL(4)
      SUMSL(4)=  2.0*SUMSL(4)/CW
C
C
      YSPAN(NSPAN)= YSPN/BOTU
      SLIFT(NSPAN)=-SUMSL(4)*(SUMSL(3)*COSA + SUMSL(1)*SINA)
      SDRAG(NSPAN)= SUMSL(4)*(SUMSL(1)*COSA - SUMSL(3)*SINA)
      CMOMT(NSPAN)= 2.0*SPMO/CORD
      SCTS = -SUMSL(4)*SUMSL(1)
      IF (SCTS) 1290,1290,1300
 1290 SCTS = 0.0
 1300 SNFC = COSLE*SCTS
      IF (SUMSL(3)) 1310,1320,1320
 1310 SNFC= -SNFC
 1320 CONTINUE
      SCLV(NSPAN)=   -SNFC*COSA - SCTS*SINA
      SCDV(NSPAN)=    SCTS*COSA - SNFC*SINA
      SPMV(NSPAN)=    SNFC*(XLE-XCO4)/CW
C
C
 1330 CONTINUE
C
C
      LINES= LINES+3
      IF (LINEX-LINES) 1340,1350,1350
 1340 CALL PAGE
      LINES= LINES+3
      GO TO 1360
 1350 WRITE (KOUT,1010)
 1360 CONTINUE
C
C
C
      CALL CURFIT(YSPAN, SLIFT,ALIFT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SDRAG,ADRAG, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, CMOMT,AMOMT, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPN,AFLPN, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, FLAPX,AFLPX, NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCLV, ACLV,  NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SCDV, ACDV,  NSPAN,ZERO1,ZERO2,N2,N2)
      CALL CURFIT(YSPAN, SPMV, APMV,  NSPAN,ZERO1,ZERO2,N2,N2)
C
C
C
      DELTAB= 2.0/30.0
      YSPANO= -1.0
      IF (IFLG(1)-1) 1370,1380,1380
 1370 DELTAB= 1.0/30.0
      YSPANO= 0.0
 1380 CONTINUE
```

```
C
      DO 1410 J=1,31
C
      YOB= DELTAB*FLOAT(J-1) + YSPANO
      YSPN= YOB*BOTU
C
      CL   =  0.0
      CD   =  0.0
      CM   =  0.0
      CLV  =  0.0
      CDV  =  0.0
      CPV  =  0.0
      FCN  =  0.0
      FCX  =  0.0
C
      TEST= ABS(YOB) - 0.999
      IF (TEST) 1390,1400,1400
 1390 CONTINUE
C
      CALL CURVE(YSPAN,SLIFT,ALIFT, YOB,CL, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SDRAG,ADRAG, YOB,CD, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,CMOMT,AMOMT, YOB,CM, DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPN,AFLPN, YOB,FCN,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,FLAPX,AFLPX, YOB,FCX,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SCLV, ACLV,  YOB,CLV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SCDV, ACDV,  YOB,CDV,DUMYK,NSPAN,N1)
      CALL CURVE(YSPAN,SPMV, APMV,  YOB,CPV,DUMYK,NSPAN,N1)
C
 1400 CONTINUE
C
C
C
      RCL(NCLC,J) = CL
      RCD(NCLC,J) = CD
      RCM(NCLC,J) = CM
      RCLV(NCLC,J)= CLV
      RCDV(NCLC,J)= CDV
      RPMV(NCLC,J)= CPV
      RCFL(NCLC,J)= FCN*COSA - FCX*SINA
      RCFD(NCLC,J)= FCX*COSA + FCX*SINA
      RYSPAN(  J) = YOB
C
C
 1410 CONTINUE
C
C
 1420 CONTINUE
C
C
      DELCL= EXECK(2)-WCL
      EXECK(15) = 0.0
      SCL1= WCL**2
      SCL2= SCL1 - EXECK(2)**2
      WCLVS(2)=  ( WCLVS(1) - WCLVS(2) )/SCL2
      WCLVS(1)=    WCLVS(1) - WCLVS(2)*SCL1
      WCDVS(2)=  ( WCDVS(1) - WCDVS(2) )/SCL2
      WCDVS(1)=    WCDVS(1) - WCDVS(2)*SCL1
      WCPVS(2)=  ( WCPVS(1) - WCPVS(2) )/SCL2
      WCPVS(1)=    WCPVS(1) - WCPVS(2)*SCL1
      WCPOS(2)=  ( WCPOS(2) - WCPOS(1) )/DELCL
      WCPOS(1)=    WCPOS(1) - WCPOS(2)*WCL
      WCDIS(2)=  ( WCDIS(1) - WCDIS(2) )/SCL2
      WCDIS(1)= 0.0
C
      DO 1460 J=1,31
      CFNS =  RCFL(1,J)**2
C
      TEST =  CFNS - RCFL(2,J)**2
      ATEST= ABS(TEST)-0.001
      IF (ATEST) 1430,1430,1440
 1430 RCFD(2,J)= 0.0
      GO TO 1450
 1440 RCFD(2,J)= (RCFD(1,J)-RCFD(2,J))/TEST
 1450 RCFD(1,J)= RCFD(1,J) - RCFD(2,J)*CFNS
      RCFL(2,J)= (RCFL(2,J)-RCFL(1,J))/DELCL
      RCFL(1,J)=  RCFL(1,J)-RCFL(2,J)*WCL
      RCM(2,J)= (RCM(2,J)-RCM(1,J))/DELCL
      RCM(1,J)= RCM(1,J) - RCM(2,J)*WCL
C
      SCL1= WCL**2
      SCL2= SCL1-EXECK(2)**2
      RCLV(2,J)= (RCLV(1,J)-RCLV(2,J))/SCL2
      RCLV(1,J)=  RCLV(1,J)-RCLV(2,J)*SCL1
      RCDV(2,J)= (RCDV(1,J)-RCDV(2,J))/SCL2
      RCDV(1,J)=  RCDV(1,J)-RCDV(2,J)*SCL1
      RPMV(2,J)= (RPMV(1,J)-RPMV(2,J))/SCL2
      RPMV(1,J)=  RPMV(1,J)-RPMV(2,J)*SCL1
C
      SCL1= RCL(1,J)**2
      SCL2= SCL1 - RCL(2,J)**2
      RCD(2,J) = (RCD(1,J) -RCD(2,J) )/SCL2
      RCD(1,J) =  RCD(1,J) -RCD(2,J)*SCL1
      CLA1(J)= (RCL(2,J)-RCL(1,J))/DELCL
 1460 CLB(J) =  RCL(1,J) - CLA1(J)*WCL
C
C
      WLIFTS=  DELCL/DELALF
      WPMOSL= (EXECK(3)-WPMO)/DELALF
      WRMOSL= (EXECK(4)-WRMO)/DELALF
      WYMOSL= (EXECK(5)-WYMO)/DELALF
C
      ALFA   = ALFA - DELALF
      ALFARO= ALFA - WCL/WLIFTS
C
C
      LINES= LINES+10
```

```
      IF (LINEX-LINES) 1470,1480,1480
 1470 CALL PAGE
      LINES= LINES+10
 1480 WRITE (KOUT,1020)ALFA,ALFARO,WCL,WLIFTS,WPMOSL,WRMOSL,WYMOSL
C
      DO 1540 J=1,31
      IF (J-1) 1490,1490,1520
 1490 LINES= LINES+ 2
      IF (LINEX-LINES) 1500,1510,1510
 1500 CALL PAGE
      LINES= LINES+2
 1510 WRITE (KOUT,1030)
 1520 LINES= LINES+1
      IF (LINEX-LINES) 1500,1530,1530
 1530 CONTINUE
      YSPN= RYSPAN(J)*BOTU
      WRITE (KOUT,1040)YSPN,RYSPAN(J),CLA1(J),CLB(J),RCL(1,J),RCM(1,J)
 1540 CONTINUE
C
C
C
C    * LINEARIZED SOLUTION ARRAY *
C
      IF (WINGCL(1)-1) 1550,1570,1570
 1550 CONTINUE
      DO 1560 N=2,NJOBL
      M= N-1
 1560 WINGCL(N)= WLIFTS*( ALFAL(M)-ALFARO)
 1570 CONTINUE
      SLOPEO = 0.5/PIE
      SLOPEW = 1.0/(WLIFTS*RAD)
      IRECN= 0
      IWORD=10
C
C
      DO 1830 N=2,NJOBL
C
C
      WCL= WINGCL(N)
      ALFA= WCL/WLIFTS + ALFARO
      SIGNL= 1.0
      IF (WCL) 1580,1590,1590
 1580 SIGNL= -1.0
 1590 CONTINUE
      IRECN= IRECN +1
C
      LINES= LINES + LINEX
      IF (LINEX-LINES) 1600,1610,1610
 1600 CALL PAGE
      LINES= LINES +10
 1610 WRITE (KOUT,1020)ALFA,ALFARO,WCL,WLIFTS,WPMOSL,WRMOSL,WYMOSL
C
      DO 1770 J=1,31
C
      YSPN= RYSPAN(J)*BOTU
      RCL(1,J)= CLA1(J)*WCL + CLB(J)
C
      CALL CHORDT(YSPN,XLE,XC04,XTE,XHE,CW,CF)
C
      SCL1= RCL(1,J)**2
      SCL2= WCL**2
      RCL(2,J)= RCD(1,J) + RCD(2,J)*SCL1
      IF (LDRAG-1) 1640,1620,1620
 1620 RCL(2,J)= 0.0
      IF (CLA1(J)) 1640,1640,1630
 1630 RCL(2,J)= (SLOPEW/CLA1(J)-SLOPEO)*SCL1
 1640 CMAC= RCM(1,J) + RCM(2,J)*WCL
C
      CLV = ( RCLV(1,J) + RCLV(2,J)*SCL2 )*SIGNL   + RCL(1,J)
      CPV = ( RPMV(1,J) + RPMV(2,J)*SCL2 )*SIGNL   + CMAC
      CDV = ( RCDV(1,J) + RCDV(2,J)*SCL2 )         + RCL(2,J)
      CMLFT= (WINGD(11)-XC04)*(RCL(1,J)*COSA + RCL(2,J)*SINA)
      FCN = RCFL(1,J) + RCFL(2,J)*WCL
      FCX = RCFD(1,J) + RCFD(2,J)*(FCN**2)
      CFNS= FCN*COSA + FCX*SINA
      FCX = FCX*COSA - FCN*SINA
      FCN = CFNS
      FCM = -FCN/4.0
C
      IF (J-1) 1650,1650,1680
 1650 LINES= LINES + 4
      IF (LINEX-LINES) 1660,1660,1670
 1660 CALL PAGE
      LINES= LINES + 4
 1670 WRITE (KOUT,1050)
 1680 LINES= LINES + 1
      IF (LINEX-LINES) 1660,1690,1690
 1690 CONTINUE
C
      NOFLPX= NOFLAP + NOAILR
      IF (NOFLPX) 1700,1700,1710
 1700 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV
      GO TO 1720
 1710 WRITE (KOUT,1060)YSPN,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,CLV,CDV,CPV
     1,FCN,FCX,FCM
 1720 CONTINUE
C
      IF (J-1) 1730,1730,1740
 1730 CONTINUE
      SUMS= 0.0
      SUMC= 0.0
      SUML= 0.0
      SUMD= 0.0
      SUMP= 0.0
      GO TO 1750
 1740 DELTAS= 0.25*(YSPN-YSPNP)*(CW+CWF)
```

```
      SUMS= SUMS + 2.0*DELTAS
      SUMC= SUMC + DELTAS*(CW+CWF)
      SUML= SUML + DELTAS*(RCL(1,J)+RCL1)
      SUMD= SUMD + DELTAS*(RCL(2,J)+RCL2)
      SUMP= SUMP + DELTAS*(CW*RCM(1,J)+CWF*RCM1+CMLFT+CMLFT1)
 1750 CONTINUE
C
      CWF= CW
      YSPNP= YSPN
      RCL1= RCL(1,J)
      RCL2= RCL(2,J)
      RCM1= RCM(1,J)
      CMLFT1= CMLFT
C
      IF (IFLG(14)-1) 1770,1760,1760
 1760 WRITE(KT2)IRECN,IWORD,RYSPAN(J),RCL(1,J),RCL(2,J),CMAC,
     1                          FCN,FCX,FCM,  CLV,CDV,CPV
 1770 CONTINUE
C
C
      WCD= SUMD/SUMS
      WCMAC= WCPOS(1) + WCPOS(2)*WCL
      WLOD= WCL/WCD
C
      SCL2  =  WCL**2
      WCLV = ( WCLVS(1)  + WCLVS(2)*SCL2 )*SIGNL  + WCL
      WPMV = ( WCPVS(1)  + WCPVS(2)*SCL2 )*SIGNL  + WCMAC
      WCDV = ( WCDVS(1)  + WCDVS(2)*SCL2 )        + WCD
      WLODV=  WCLV/WCDV
C
      IF (N-4) 1780,1790,1800
 1780 M=N-1
      WCD3(M)= WCD
      WCL3(M)= WCL
      WCL4(M)= WCL**2
C
      IF (N-4) 1800,1790,1800
 1790 WCD3(3) = ( WCD3(2) - WCD3(3) )/( WCL3(2) - WCL3(3) )
      WCD3(2) = ( WCD3(1) - WCD3(2) )/( WCL3(1) - WCL3(2) )
      WCL3(3) = ( WCL4(2) - WCL4(3) )/( WCL3(2) - WCL3(3) )
      WCL3(2) = ( WCL4(1) - WCL4(2) )/( WCL3(1) - WCL3(2) )
      WCDIS(2)= ( WCD3(2)-WCD3(3) )/( WCL3(2) - WCL3(3) )
      WCDIS(1)= WCD3(2) - WCDIS(2)*WCL3(2)
      SKINFC = SKINFC + WCD3(1) - WCDIS(1)*WCL3(1) - WCDIS(2)*WCL4(1)
 1800 CONTINUE
C
      LINES= LINES+3
      IF (LINEX-LINES) 1810,1820,1820
 1810 CALL PAGE
      LINES= LINES+3
 1820 WRITE (KOUT,1070)WCL,WCD,WCMAC,WLOD,WCLV,WCDV,WPMV,WLODV
C
 1830 CONTINUE
C
C
      CALL PAGE
      WRITE (KOUT,1080)
      KALFA= IFIX( ALFARO - 2.0 )
      LINES= LINES + 9
      IRECN= IRECN +1
      IWORD= 7
C
      NIMAX= 20.0 -ALFARO
      DO 1870 N=1,NIMAX
      ALFA= FLOAT( N + KALFA )
      WCL  = WLIFTS*( ALFA-ALFARO )
      SCL2 = WCL**2
      WCD  = SKINFC + WCDIS(1)*WCL + WCDIS(2)*SCL2
      WCMAC= WCPOS(1) + WCPOS(2)*WCL
      WCLV = WCLVS(1) + WCLVS(2)*SCL2
      WCDV = WCDVS(1) + WCDVS(2)*SCL2
      WPMV = WCPVS(1) + WCPVS(2)*SCL2
C
      IF (WCL) 1840,1850,1850
 1840 WCLV = WCLVS(1) + WCLVS(1) -WCLV
      WPMV = WCPVS(1) + WCPVS(1) - WPMV
 1850 WCLV = WCLV + WCL
      WCDV = WCDV + WCD
      WPMV = WPMV + WCMAC
C
      WRITE (KOUT,1090)ALFA,WCL,WCD,WCMAC,WCLV,WCDV,WPMV
C
      IF (IFLG(14)-1) 1870,1860,1860
 1860 CONTINUE
      WRITE(KT2)IRECN,IWORD,ALFA,WCL,WCD,WCMAC,WCLV,WCDV,WPMV
 1870 CONTINUE
C
C
      IF (IFLG(14)-1) 1890,1880,1880
 1880 LINES= LINES +2
      IFLG(15)= IFLG(15) +1
      END FILE KT2
      WRITE (KOUT,1100)IFLG(15)
 1890 CONTINUE
C
C
 1900 RETURN
C     XXXXXX
C
C
      END


∇ FOR 807,807
C
```

```
C
C
      SUBROUTINE SPANI(IFLAG,NSPS,NDIS,SPAN,    YSPAN)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION YSPAN(42)
      COMMON/DATA02/IFLG(15)      ,EXECK(15)     ,RAD   ,PIE
      COMMON/DATA04/YFLAP1,YFLAP2,FLAPC
     *              ,YAILRN,AILRNC,WSMOTH
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      IF (IFLAG-1) 1000,1020,1250
C
C
C
C   * FIXED SPACING *
C
 1000 CONTINUE
C
      DELTA= SPAN/FLOAT(NSPS-1)
      BOTU= SPAN/2.0 + DELTA
C
      DO 1010 K=1,NSPS
 1010 YSPAN(K)=-BOTU + DELTA*FLOAT(K)
C
      RETURN
C     XXXXXX
C
C
C
C   * VARIABLE SPACING *
C
 1020 CONTINUE
C
      PHI= PIE*( 1.0 + FLOAT(NDIS) )
      DPHI= PHI/FLOAT(NSPS-1)
      BOTU= SPAN/2.0
      DBO  = 0.5*SPAN/FLOAT(NDIS+1)
C
C
      PIEF= PIE
      PIEM= 1.0
C
      DO 1040 N=1,NSPS
      PHI= DPHI*FLOAT(N-1)
      IF (PHI-PIEF) 1040,1040,1030
 1030 PIEF= PIE + PIEF
      PIEM= PIEM + 2.0
 1040 YSPAN(N)= -BOTU + DBO*(PIEM - COS(PHI+PIE-PIEF))
C
C
      IF (YFLAP2) 1250,1250,1050
 1050 YF1= YFLAP1
      YF2= YFLAP2
      TEST= YFLAP1-1.0
      IF (TEST) 1060,1060,1070
 1060 YF1= YF1*BOTU
      YF2= YF2*BOTU
 1070 CONTINUE
C
      IF (NDIS-1) 1250,1250,1080
 1080 IF (NDIS-3) 1090,1090,1150
 1090 Y1 = DBO*FLOAT(NDIS-1)
C
C
C   * NDIS=2 OR 3 *
C
      RAT1= YF2/Y1
      RAT2= (BOTU-YF2)/(BOTU-Y1)
      DO 1140 N=1,NSPS
      T1 = YSPAN(N) + Y1
      T2 = YSPAN(N) - Y1
      IF (T1) 1100,1100,1110
 1100 YSPAN(N)= -YF2 + (YSPAN(N)+Y1)*RAT2
      GO TO 1140
 1110 IF (T2) 1120,1120,1130
 1120 YSPAN(N)= YSPAN(N)*RAT1
      GO TO 1140
 1130 YSPAN(N)= YF2 + (YSPAN(N)-Y1)*RAT2
 1140 CONTINUE
      GO TO 1250
C
C
C   * NDIS= 4 *
C
 1150 Y1= DBO
      Y2= 3.0*Y1
      RAT0 =  YF1/Y1
      RAT1 =  (YF2-YF1)/(Y2-Y1)
      RAT2 =  (BOTU-YF2)/(BOTU-Y2)
      DO 1240 N=1,NSPS
      T1 = YSPAN(N) + Y2
      T2 = YSPAN(N) + Y1
      T3 = YSPAN(N) - Y1
      T4 = YSPAN(N) - Y2
      IF (T1) 1160,1160,1170
 1160 YSPAN(N)= -YF2 +(YSPAN(N)+Y2)*RAT2
      GO TO 1240
 1170 IF (T2) 1180,118C,1190
```

```
 1180 YSPAN(N)= -YF1 +(YSPAN(N)+Y1)*RAT1
      GO TO 1240
 1190 IF (T3) 1200,1200,1210
 1200 YSPAN(N)= YSPAN(N)*RATO
      GO TO 1240
 1210 IF (T4) 1220,1220,1230
 1220 YSPAN(N)= YF1 + (YSPAN(N)-Y1)*RAT1
      GO TO 1240
 1230 YSPAN(N)= YF2 + (YSPAN(N)-Y2)*RAT2
 1240 CONTINUE
C
C
 1250 RETURN
C     XXXXXX
C
C
      END


V FOR 808,808
C
C
C
      SUBROUTINE CHORDI( IFLAG,NCV,NDIS,  XV,XN,XC)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION XV(10),XN(10),XC(11)
      COMMON/DATA02/IFLG(15)      ,EXECK(15)     ,RAD    ,PIE
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      COLOCP= EXECK(11) - 1.0
      IF (IFLAG-1) 1000,1020,1020
C
C
C
C   * FIXED SPACING *
C
 1000 CONTINUE
      NP1= NCV+1
      XC(NP1)=1.0
      DELTA= 1.0/FLOAT(NCV)
      DELTA1 = -0.75*DELTA
      DELTA2 = COLOCP*DELTA
      X = 0.0
C
      DO 1010 N=1,NCV
      X= X + DELTA
      XC(N)= X
      XV(N)= X + DELTA1
 1010 XN(N)= X + DELTA2
C
      RETURN
C     XXXXXX
C
C
C
C   * VARIABLE SPACING *
C
 1020 CONTINUE
C
      NP1= NCV+1
      PHI= PIE*(1.0 + FLOAT(NDIS))
      DPHI= PHI/FLOAT(NCV)
      DCO= 0.5/FLOAT(NDIS+1)
C
      PIEF= PIE
      PIEM= 1.0
      XX= 0.0
C
      DO 1050 N=2,NP1
      M= N-1
      PHI= DPHI*FLOAT(M)
      IF (PHI-PIEF) 1040,1040,1030
 1030 PIEF= PIEF + PIE
      PIEM= PIEM + 2.0
 1040 PHIX= PHI+PIE-PIEF
      XC(M)= DCO*(PIEM-COS(PHIX))
      DELTA= XC(M)-XX
      XX = XC(M)
      XV(M)= XX-0.75*DELTA
      XN(M)= XX +COLOCP*DELTA
 1050 CONTINUE
C
      RETURN
C     XXXXXX
C
C
C
      END


V FOR 809,809
C
C
C
      SUBROUTINE CHORDT(Y,  XLE,XC04,XTE,XHE,CW,CF)
C
```

```
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      COMMON/DATA05/WINGD(15)      ,EY(42,10)     ,EC(42,10)     ,ES(42,10)
     *,EYE(10)      ,ELE(10)       ,ETE(10)       ,EHE(10)       ,EG(42,10)
     *,EN(42,10,6)  ,EV(42,10,6)  ,VVINOX(42,10,3)
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      YA= ABS(Y)
      M = -1
      DO 1020 L=2,10
      IF (M) 1000,1000,1020
 1000 TEST= YA-EYE(L)+0.001
      IF (TEST) 1010,1010,1020
 1010 M= L
 1020 CONTINUE
      IF (M-2) 1030,1040,1040
 1030 M=2
 1040 M1= M-1
C
      RAT= (YA-EYE(M1))/(EYE(M)-EYE(M1))
      XLE =  ELE(M1) +  RAT*( ELE(M)-ELE(M1) )
      XTE =  ETE(M1) +  RAT*( ETE(M)-ETE(M1) )
      XHE =  EHE(M1) +  RAT*( EHE(M)-EHE(M1) )
      CW  =  XTE - XLE
      CF  =  XTE - XHE
      XC04=  XLE + 0.25*CW
C
C
      RETURN
C     XXXXXX
C
      END


V FOR B10,B10
C
C
C
      SUBROUTINE FLAPS(YF,XHINGE,P,COSF)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3),COSF(3)
C
      COMMON/DATA00/NSTL  ,ALFAO ,CMAK  ,ZHO    ,FLAPOX,AILROX(2)
     *        ,TITLE(14)     ,STORE(14)
      COMMON/DATA02/IFLG(15)        ,EXECK(15)     ,RAD    ,PIE
      COMMON/DATA04/YFLAP1,YFLAP2,FLAPC
     *               ,YAILRN,AILRNC,WSMOTH
      COMMON/DATA06/YFF11,YFF12,YFF21,YFF22,YFF31,YFF32,DELTF1,DELTF2
     *               ,NOFLAP,NOAILR
      COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      NONO= NOFLAP + NOAILR
      DELTX= P(1)-XHINGE
      IF (DELTX) 1010,1010,1000
C
 1000 IF (NONO) 1010,1010,1020
 1010 RETURN
C     XXXXXX
C
 1020 YA= ABS(YF)
C
C
      COSX= COSF(1)
      COSZ= COSF(3)
      FLAPD= 0.0
      AILD = 0.0
C
      TST11= YA - YFF11
      TST12= YA - YFF12
      TST21= YA - YFF21
      TST22= YA - YFF22
      TST31= YA - YFF31
      TST32= YA - YFF32
C
C
      IF (NOFLAP) 1110,1110,1030
 1030 IF (YFLAP1) 1070,1070,1040
 1040 IF (TST11) 1110,1110,1050
 1050 IF (TST12) 1060,1070,1070
 1060 FLAPD = 0.5*FLAPOX*(1.0+SIN(PIE*(TST11/DELTF1-0.5)))
      GO TO 1110
 1070 IF (TST21) 1080,1080,1090
 1080 FLAPD = FLAPOX
      GO TO 1110
 1090 IF (TST22) 1100,1110,1110
 1100 FLAPD = 0.5*FLAPOX*(1.0+SIN(PIE*(TST21/DELTF2+0.5)))
C
 1110 IF (NOAILR) 1210,1120,1120
 1120 AILD = AILROX(1)
      IF (YF) 1130,1140,1140
```

```
 1130 AILO = AILRDX(2)
 1140 IF (TST21) 1150,1150,1160
 1150 AILO = 0.0
      GO TO 1210
 1160 IF (TST22) 1170,1180,1180
 1170 AILO = 0.5*AILO*(1.0 + SIN(PIE*(TST21/DELTF2 -0.5)))
      GO TO 1210
 1180 IF (TST31) 1210,1190,1190
 1190 IF (TST32) 1200,1150,1150
 1200 AILO= 0.5*AILO*(1.0 + SIN(PIE*(TST31/DELTF2+0.5)))
 1210 TAND = TAN( (AILO+FLAPD)/RAD)
C
C
      COSD= 1.0/SQRT( 1.0 + TAND**2 )
      SIND = TAND*COSD
C
      COSF(1) = COSX*COSD - COSZ*SIND
      COSF(3) = COSZ*COSD + COSX*SIND
C
      IF (LFLAP-1) 1220,1230,1230
 1220 P(1) =  P(1) - DELTX*(1.0-COSD)
      P(3) =  P(3) + DELTX*SIND
 1230 CONTINUE
C
      RETURN
C     XXXXXX
C
C
      END
```

```
V FOR B11,B11
C
C
C
      SUBROUTINE VORTEX(P,B,D,TANA,GAMA,      VI,VCOS)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3),B(3),D(3)
      DIMENSION COS1(3),COS2(3),COS3(3), X(3),A(3),VCOS(3)
      DIMENSION G(3)
C
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2   ,LINEX ,LINES
      COMMON/DATA02/IFLG(15)     ,EXECK(15)    ,RAD   ,PIE
      COMMON/DATA07/LFLAP,LDRAG,CUTOF1,CUTOF2
C
      NAMELIST/DBUGV1/P,B,D,TANA,GAMA,PSIF,VCOS
      NAMELIST/DBUGV2/PSIF,VCOS
      NAMELIST/DBUGV3/PSIF,VCOS
C
 1000 FORMAT(1X,//,1X)
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      NOTE= IFLG(10)-8
      TANAS= TANA**2
      COSA= 1.0 - TANAS/2.0
      IF (TANAS-0.0001) 1020,1010,1010
 1010 COSA= 1.0/SQRT(TANAS+1.0)
 1020 SINA= COSA*TANA
C
      SCALE= SQRT((D(1)-B(1))**2+(D(2)-B(2))**2+(D(3)-B(3))**2)
      DO 1030 K=1,3
      X(K)= (P(K)-0.5*(B(K)+D(K)))/SCALE
      A(K)= (0.5*(D(K)-B(K)))/SCALE
 1030 VCOS(K)= 0.0
C
C
C
C   * SEGMENT INF-A-B *
C
      H5   =  TANA*( X(1)+ A(1))
C
      HS1 =  (X(1)+A(1))**2  + H5**2
      HS2 =  (X(2)+A(2))**2  + (X(3)+A(3)-H5)**2
      HS3 =  (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
      H1  =  SQRT(HS1)
      H2  =  SQRT(HS2)
C
      COSG= 0.0
      SING= 1.0
      TEST = CUTOF1 - H1
C
      IF (TEST) 1040,1050,1050
 1040 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
      SING= SQRT(ABS(1.0-COSG**2))
 1050 CONTINUE
C
      R   =  H2*SING
      H4  =  H2*COSG
      SH14=  H1+H4
C
      PSIF= ( 1.0 +SH14/SQRT(SH14**2+R**2) )/R
C
      COS1(1) =  COSA
      COS1(2) =  0.0
      COS1(3) =  SINA
      COS2(1) = ( X(1)+A(1)-SH14*COSA )/R
      COS2(2) = ( X(2)+A(2) )/R
```

```
      COS2(3) = ( X(3)+A(3)-SH14*SINA )/R
C
      CALL CROSP( COS1,COS2,COS3)
C
      DO 1060 K=1,3
 1060 VCOS(K)=  PSIF*COS3(K)
C
      IF (NOTE) 1080,1070,1070
 1070 WRITE (KOUT,1000)
      WRITE (KOUT,DBUGV1)
 1080 CONTINUE
C
C
C
C   * SEGMENT D-E-INF *
C
      H5   = TANA*(X(1)-A(1))
C
      HS1 = (X(1)-A(1))**2 + H5**2
      HS2 = (X(2)-A(2))**2 + (X(3)-A(3)-H5)**2
      HS3 = (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
      H1   = SQRT(HS1)
      H2   = SQRT(HS2)
C
      COSG= 0.0
      SING= 1.0
      TEST = CUTOF1 - H1
C
      IF (TEST) 1090,1100,1100
 1090 COSG= (HS3-HS1-HS2)/(2.0*H1*H2)
      SING= SQRT(ABS(1.0-COSG**2))
 1100 CONTINUE
C
      R    = H2*SING
      H4   = H2*COSG
      SH14= H1+H4
C
      PSIF= (-1.0 -SH14/SQRT(SH14**2+R**2) )/R
C
      COS1(1)= COSA
      COS1(2)= 0.0
      COS1(3)= SINA
      COS2(1)=  ( X(1)-A(1)-SH14*COSA )/R
      COS2(2)=  ( X(2)-A(2) )/R
      COS2(3)=  ( X(3)-A(3)-SH14*SINA )/R
C
      CALL CROSP(COS1,COS2,COS3)
C
      DO 1110 K=1,3
 1110 VCOS(K)= VCOS(K) +  PSIF*COS3(K)
C
      IF (NOTE) 1130,1120,1120
 1120 WRITE (KOUT,DBUGV2)
 1130 CONTINUE
C
C
C
C   * SEGMENT B-C-D *
C
      HS1 =    4.0*( A(1)**2 + A(2)**2 + A(3)**2 )
      HS2 =   (X(1)-A(1))**2 + (X(2)-A(2))**2 + (X(3)-A(3))**2
      HS3 =   (X(1)+A(1))**2 + (X(2)+A(2))**2 + (X(3)+A(3))**2
      H1  =   SQRT(HS1)
      H2  =   SQRT(HS2)
C
      COSG=   (HS3-HS1-HS2)/(2.0*H1*H2)
      SING=   SQRT(ABS(1.0-COSG**2))
      PSIF= 0.0
      TEST =  ABS(SING) - CUTOF2
C
      IF (TEST) 1170,1170,1140
 1140 CONTINUE
C
      R    =  H2*SING
C
      TEST = R/H1 - 10.0*CUTOF1
      IF (TEST) 1170,1170,1150
 1150 CONTINUE
C
      RS   =  R**2
      H4   =  H2*COSG
      SH14=   H1+H4
      T1= 1.0 + 2.0*H4/H1
C
      PSIF= (SH14/SQRT(SH14**2+RS) -H4/SQRT(H4**2+RS))/R
C
      DO 1160 K=1,3
      G(K)= A(K)*T1
      COS1(K)= (G(K)-X(K))/R
 1160 COS2(K)= -2.0*A(K)/H1
C
      CALL CROSP(COS1,COS2,COS3)
C
 1170 CONTINUE
C
      V2= 0.0
C
      DO 1180 K=1,3
      VCOS(K)= VCOS(K) + PSIF*COS3(K)
 1180 V2= V2 + VCOS(K)**2
C
      IF (NOTE) 1200,1190,1190
 1190 WRITE (KOUT,DBUGV3)
      LINES= LINEX - 10
 1200 CONTINUE
C
```

```
      VI= SQRT(V2)
      DO 1210 K=1,3
 1210 VCOS(K)= VCOS(K)/VI
C
      VI= VI*(GAMA/SCALE)
C
      RETURN
C     XXXXXX
C
      END
```

```
∇ FOR B12,B12
C
C
C
      SUBROUTINE REFLEC(P,ZL,ALFAR,COSR)
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION P(3)
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2   ,LINEX ,LINES
      COMMON/DATA02/IFLG(15)    ,EXECK(15)    ,RAD   ,PIE
      NAMELIST/REFLEX/PX,PY,X1,Y1,PHI,ALFAR,RX,RY,ZL,COSR
      DATA X2/0.0/, Y2/0.0/
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      PX= P(3)
      PY= P(1)
      X1= ZL/COSR
      Y1= 0.0
      PHI= -ALFAR
      NOTE= IFLG(10)-15
C
      CALL ROTATE(PX,PY,X1,Y1,PHI,X2,Y2,RX,RY)
C
      IF (NOTE) 1010,1010,1000
 1000 WRITE (KOUT,REFLEX)
 1010 CONTINUE
C
      RX=-RX
C
      CALL ROTATE(RX,RY,X2,Y2,ALFAR,X1,Y1,PX,PY)
C
      IF (NOTE) 1030,1030,1020
 1020 WRITE (KOUT,REFLEX)
      LINES= LINES+24
 1030 CONTINUE
C
      P(3)= PX
      P(1)= PY
C
      RETURN
C     XXXXXX
C
      END
```

```
∇ FOR B13,B13
C
C
C
      SUBROUTINE DMATIN(A,N,DETERM)
C
C     MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
C   * VERSION 2 ROUTINE (DOUBLE PRECISSION-LANGLEY MATINV SUBROUTINE) *
C
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DOUBLE PRECISION R1,R2,DETERM,AMAX,T,SWAP,PIVOT,PIVOTI
      DOUBLE PRECISION IPIVOT(71),A(71,71),B(1,1),INDEX(71,2)
      EQUIVALENCE (IROW,JROW), (ICOLUM,JCOLUM), (AMAX, T, SWAP)
      M= 0
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
C     INITIALIZATION
C
 1000 ISCALE=0
 1010 R1 = 1.E36
 1020 R2=1.0/R1
 1030 DETERM=1.0
 1040 DO 1050 J=1,N
 1050 IPIVOT(J)=0
 1060 DO 1630 I=1,N
C
C     SEARCH FOR PIVOT ELEMENT
C
 1070 AMAX=0.0
 1080 DO 1170 J=1,N
 1090 IF (IPIVOT(J)-1) 1100,1170,1100
 1100 DO 1160 K=1,N
 1110 IF (IPIVOT(K)-1) 1120,1160,1750
```

```
1120 IF (DABS(AMAX)-DABS(A(J,K))) 1130,1160,1160
1130 IROW=J
1140 ICOLUM=K
1150 AMAX=A(J,K)
1160 CONTINUE
1170 CONTINUE
     IF (AMAX) 1190,1180,1190
1180 DETERM=0.0
     ISCALE=0
     GO TO 1750
C    XXXXXX
C
C
1190 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C
C    INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
C
1200 IF (IROW-ICOLUM) 1210,1310,1210
1210 DETERM=-DETERM
1220 DO 1250 L=1,N
1230 SWAP=A(IROW,L)
1240 A(IROW,L)=A(ICOLUM,L)
1250 A(ICOLUM,L)=SWAP
C
C
1260 IF (M) 1310,1310,1270
1270 DO 1300 L=1,M
1280 SWAP=B(IROW,L)
1290 B(IROW,L)=B(ICOLUM,L)
1300 B(ICOLUM,L)=SWAP
1310 INDEX(I,1)=IROW
1320 INDEX(I,2)=ICOLUM
1330 PIVOT=A(ICOLUM,ICOLUM)
     IF (PIVOT) 1340,1180,1340
C
C    SCALE THE DETERMINANT
C
1340 PIVOTI=PIVOT
1350 IF (DABS(DETERM)-R1) 1380,1360,1360
1360 DETERM=DETERM/R1
     ISCALE=ISCALE+1
     IF (DABS(DETERM)-R1) 1410,1370,1370
1370 DETERM=DETERM/R1
     ISCALE=ISCALE+1
     GO TO 1410
1380 IF (DABS(DETERM)-R2) 1390,1390,1410
1390 DETERM=DETERM*R1
     ISCALE=ISCALE-1
     IF (DABS(DETERM)-R2) 1400,1400,1410
1400 DETERM=DETERM*R1
     ISCALE=ISCALE-1
1410 IF (DABS(PIVOTI)-R1) 1440,1420,1420
1420 PIVOTI=PIVOTI/R1
     ISCALE=ISCALE+1
     IF (DABS(PIVOTI)-R1) 1470,1430,1430
1430 PIVOTI=PIVOTI/R1
     ISCALE=ISCALE+1
     GO TO 1470
1440 IF (DABS(PIVOTI)-R2) 1450,1450,1470
1450 PIVOTI=PIVOTI*R1
     ISCALE=ISCALE-1
     IF (DABS(PIVOTI)-R2) 1460,1460,1470
1460 PIVOTI=PIVOTI*R1
     ISCALE=ISCALE-1
1470 DETERM=DETERM*PIVOTI
C
C    DIVIDE PIVOT ROW BY PIVOT ELEMENT
C
1480 A(ICOLUM,ICOLUM)=1.0
1490 DO 1500 L=1,N
1500 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT
C
C
1510 IF (M) 1540,1540,1520
1520 DO 1530 L=1,M
1530 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT
C
C    REDUCE NON-PIVOT ROWS
C
1540 DO 1630 L1=1,N
1550 IF (L1-ICOLUM) 1560,1630,1560
1560 T=A(L1,ICOLUM)
1570 A(L1,ICOLUM)=0.0
1580 DO 1590 L=1,N
1590 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
C
C
1600 IF (M) 1630,1630,1610
1610 DO 1620 L=1,M
1620 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
1630 CONTINUE
C
C    INTERCHANGE COLUMNS
C
1640 DO 1740 I=1,N
1650 L=N+1-I
1660 IF (INDEX(L,1)-INDEX(L,2)) 1670,1740,1670
1670 JROW=INDEX(L,1)
1680 JCOLUM=INDEX(L,2)
1690 DO 1730 K=1,N
1700 SWAP=A(K,JROW)
1710 A(K,JROW)=A(K,JCOLUM)
1720 A(K,JCOLUM)=SWAP
1730 CONTINUE
1740 CONTINUE
1750 RETURN
```

```
C      XXXXXX
C
       END


∇ FOR B14,B14
C
C
C
       SUBROUTINE DOTP(A,B,C)
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
       DIMENSION A(3),B(3)
       C= A(1)*B(1)+ A(2)*B(2)+ A(3)*B(3)
C
       RETURN
C      XXXXXX
C
       END


∇ FOR B15,B15
C
C
C
       SUBROUTINE CROSP( A,B,C)
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
       DIMENSION A(3),B(3),C(3)
C
       C(1)= A(2)*B(3) - A(3)*B(2)
       C(2)= A(3)*B(1) - A(1)*B(3)
       C(3)= A(1)*B(2) - A(2)*B(1)
C
       RETURN
C      XXXXXX
C
       END


∇ FOR B16,B16
C
C
C
       SUBROUTINE ROTATE( X,Y, XO,YO, PHI,  XF,YF, XT,YT )
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
       XS = X-XO
       YS = Y-YO
       RHO= SQRT( XS**2 + YS**2)
       ERROR= 0.0001
       TESTX= ABS(XS)-ERROR
       TESTY= ABS(YS)-ERROR
       IF (TESTX) 1000,1000,1030
 1000  IF (TESTY) 1010,1010,1020
 1010  ZET= 0.0
       GO TO 1110
 1020  ZET= 1.570795*(YS/ABS(YS)) - XS/YS
       GO TO 1110
 1030  ZET= ABS(YS/XS)
       IF (TESTY) 1050,1050,1040
 1040  ZET=ATAN(ZET)
 1050  CONTINUE
       IF (XS) 1070,1050,1060
 1060  IF (YS) 1100,1110,1110
 1070  IF (YS) 1090,1080,1080
 1080  ZET= 3.14159 - ZET
       GO TO 1110
 1090  ZET= 3.14159 + ZET
       GO TO 1110
 1100  ZET= 6.28318 - ZET
 1110  CONTINUE
       ZPP= PHI + ZET
       XR = RHO*COS(ZPP)
       YR = RHO*SIN(ZPP)
       XT= XF + XR
       YT= YF + YR
C
       RETURN
C      XXXXXX
C
       END


∇ FOR B17,B17
C
C
C
       SUBROUTINE CURFIT(X,Y,A, N, DY1,DY2, K1,K2)
C
```

```
C     * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C     * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION X(22),Y(22),A(42),B(42),C(1)
C     ****************************************
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C.....FOR THE WHOLE TABULATED TABLE
C     X(I) = INDEPENDENT VARIABLE.....I=1,N  (GIVEN)
C     Y(I) = DEPENDENT VARIABLE.....I=1,N  (GIVEN)
C     N = LENGTH OF Y-VS-X TABLE  (GIVEN)
C     DY1 = 1ST OR 2ND DERIVATIVE AT LOWER END OF TABLE
C     DY2 = 1ST OR 2ND DERIVATIVE AT UPPER END OF TABLE
C     K1 = 1 ......DY1 = 1ST DERIVATIVE   (GIVEN)
C     K1 = 2 ......DY1 = 2ND DERIVATIVE   (GIVEN)
C     K2 = 1 ......DY2 = 1ST DERIVATIVE   (GIVEN)
C     K2 = 2 ......DY2 = 2ND DERIVATIVE   (GIVEN)
C
C    THE DIMENSION C(1) MUST FOLLOWS THE DIMENSION OF B
C    MINIMUM DIMENSION OF B IS......(2*N-2)
C    DIMENSION OF A IS SAME AS B, BUT GIVEN IN MAIN PROGRAM
C
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      C(1)=0.0
      NRNG= 100
C
      N1 = N-2
      C1 = X(2)-X(1)
      IF (C1) 1170,1170,1000
 1000 GO TO (1010,1020),K1
 1010 B(1) = 0.0
      A(1) = (DY1-(Y(2)-Y(1))/C1)/C1
      GO TO 1030
 1020 B(1) = -C1
      A(1) = -DY1/2.0
 1030 J = 1
C
      IF (N1) 1150,1090,1040
 1040 IF (NRNG-N) 1150,1050,1050
C
 1050 DO 1060 I=1,N1
      K = I+1
      J = J+1
      C1 = X(K)-X(I)
      C2 = X(K+1)-X(K)
      C3 = Y(K)-Y(I)
      C4 = Y(K+1)-Y(K)
      C5 = C3/C1-C4/C2
      C6 = C1/C2
      C7 = C1*C2
      B(J) = 1.0/(C6*(C1-B(J-1)))
      A(J) = (C5/C2-C6*A(J-1))*B(J)
      J = J+1
      B(J) = 1.0/((-C1-C2)/C7-C6*B(J-1))
      A(J) =(-C5/C7-C6*A(J-1))*B(J)
 1060 CONTINUE
C
      GO TO (1070,1080),K2
 1070 A(J+1) = (DY2-C4/C2+C2*A(J))/(C2*(B(J)-C2))
      GO TO 1120
 1080 A(J+1) = (DY2/2.+A(J))/(-2.*C2+B(J))
      GO TO 1120
C
C     STATEMENTS 42 TO 44 ARE FOR N=2 ONLY
C
 1090 C3 = K1
      C2 = 1.0/C3
      GO TO (1100,1110),K2
 1100 A(J+1) = ((Y(2)-Y(1))/C1-A(J)*C1-DY2)/(C1*C1)*C2
      GO TO 1120
 1110 A(J+1) = C3*((DY2+2.0*A(1))/(4.0*C1))
C
 1120 J = 2*(N-1)
C
 1130 J = J-1
      IF (J) 1170,1170,1140
 1140 A(J) = A(J)-B(J)*A(J+1)
      GO TO 1130
C
C
 1150 WRITE (6,1160)N,NRNG
C     CALL EXIT
 1160 FORMAT(4HON =I5,3X9HIN CURFIT/31H ......N MUST BE IN THE RANGE
     1 13HBETWEEN 2 AND15/39HO*INCREASE DIMENSION OF  B  IN  CURFIT
     2 19HIF  N  IS TOO LARGE /12HOB = 2*(N-1) )
 1170 RETURN
C
C     XXXXXX
C
      END


∇ FOR 818,818
C
C
C
      SUBROUTINE CURVE(X,Y,A,    XP,YP,DYP,N,IT)
C
```

```
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DIMENSION X(22),Y(22),A(42)
C      ****************************
C
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C.....USING A(I) COMPUTED IN CURFIT SUBROUTINE
C      XP = A PARTICULAR VALUE OF -X-   (GIVEN)
C      YP = A PARTICULAR VALUE OF -Y-
C      DYP = DY/DX AT -XP-
C      IT = EFFICIENCY CONTROL INDEX  (GIVEN)
C        IT = 1 .....ONLY YP IS COMPUTED
C        IT = 2 .....ONLY DYP IS COMPUTED
C        IT = 3.....BOTH YP AND DYP ARE COMPUTED
C
C      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      IF (X(1)-XP) 1020,1020,1000
 1000 C1 = X(2)-X(1)
      DYP = (Y(2)-Y(1))/C1+A(1)*C1
      GO TO (1010,1100,1010),IT
 1010 YP = Y(1)+DYP*(XP-X(1))
      GO TO 1100
 1020 N = N
      IF (XP-X(N)) 1050,1030,1030
 1030 N2 = 2*(N-1)
      C1 = X(N)-X(N-1)
      DYP = (Y(N)-Y(N-1))/C1-A(N2-1)*C1-A(N2)*C1*C1
      GO TO (1040,1100,1040),IT
 1040 YP = Y(N)+DYP*(XP-X(N))
      GO TO 1100
 1050 I = 1
 1060 I = I+1
      IF (X(I)-XP) 1060,1070,1070
 1070 K = 2*I-3
      C1 = XP-X(I-1)
      C2 = X(I)-XP
      SLOPE = (Y(I)-Y(I-1))/(X(I)-X(I-1))
      GO TO (1080,1090,1080),IT
 1080 YP = Y(I-1)+(SLOPE+A(K)*C2+A(K+1)*C1*C2)*C1
      GO TO (1100,1090,1090),IT
 1090 DYP = SLOPE +A(K)*(C2-C1)+        A(K+1)*(2.*C2-C1)*C1
 1100 RETURN
C      XXXXXX
C
      END
```

```
V FOR B19,B19
C
C
C
      SUBROUTINE PAGE
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      COMMON/DATA00/NSTL  ,ALFAC ,CMAK  ,ZHO   ,FLAPDX,AILRDX(2)
     *       ,TITLE(14)    ,STORE(14)
C
      COMMON/DATA01/KIN   ,KOUT  ,KT1   ,KT2   ,LINEX ,LINES
C
      COMMON/DATA02/IFLG(15)      ,EXECK(15)     ,RAD    ,PIE
C
C
 1000 FORMAT(38H1JOBFLAG  1  2  3  4  5  6  7  8  9 10,2X,13A6,A2,3X,
     1 4HPAGE,/,2X,5HVALUE,1X,10I3,2X,
     2 5HALFA=,F6.2,2X,7HMACHNO=,F6.4,2X,6HFLAPD=,F6.2,2X,9HAILEROND=,
     3 2F6.2,2X,9HALTITUDE=,F6.2,2X,I4,//,1X)
C
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
      IF (NSTU-1971) 1010,1020,1010
 1010 NSTU= 1971
      NP= 0
 1020 NP= NP+1
      WRITE (KOUT,1000)(TITLE(I),I=1,14),(IFLG(I),I=1,10),ALFAO,CMAK,FLA
     1PDX,(AILRDX(I),I=1,2),ZHO,NP
      LINES= 5
C
      RETURN
C      XXXXXX
C
      END
```

```
V FOR B20,B20
C
C
C
C     MAIN ROUTINE
C     TEST MATRIX INVERSION
C
C      * TRW MULTIPLE-SURFACE VORTEX-LATTICE PROGRAM - REVISED 8 AUG.72 *
C      * PROGRAM DEVELOPED BY A.V.GOMEZ (TRW SYSTEMS) ON MARCH-MAY 1971 *
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C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
      DOUBLE PRECISION DELTA,AMAT(71,71),BMAT(71,71),CMAT(71,71)
 1000 FORMAT((10X,I5,2F14.4 ) )
 1010 FORMAT( 1X,/,1X )
 1020 FORMAT((10X,5(1PE14.6) ))
C
C     XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
C
C
C
      NOR= 5
C
      AMAT(1,1) = 1.032
      AMAT(1,2) = 7.865
      AMAT(1,3) = 3.216
      AMAT(1,4) = 3.031
      AMAT(1,5) = 10.32
      AMAT(2,1) = 7.68
      AMAT(2,2) = -6.39
      AMAT(2,3) = 8.900
      AMAT(2,4) = -1.02
      AMAT(2,5) = 5.690
      AMAT(3,1) = 3.030
      AMAT(3,2) = -3.38
      AMAT(3,3) = -11.67
      AMAT(3,4) = 4.180
      AMAT(3,5) = -3.60
      AMAT(4,1) = -2.93
      AMAT(4,2) = 5.670
      AMAT(4,3) = 8.323
      AMAT(4,4) = 9.073
      AMAT(4,5) = 0.0378
      AMAT(5,1) = -.0578
      AMAT(5,2) = 7.103
      AMAT(5,3) = 9.992
      AMAT(5,4) = 0.976
      AMAT(5,5) = 15.14
C
      DO 1040 J=1,NOR
      DO 1030 K=1,NOR
 1030 BMAT(J,K)= AMAT(J,K)
 1040 CONTINUE
C
      CALL DMATIN(BMAT,NOR,DELTA)
C
      DO 1070 K=1,NOR
      DO 1060 J=1,NOR
      CMAT(J,K)= 0.0
      DO 1050 L=1,NOR
 1050 CMAT(J,K)=  CMAT(J,K) + AMAT(J,L)*BMAT(L,K)
 1060 CONTINUE
 1070 CONTINUE
C
      CALL PAGE
      WRITE (6,1020)((AMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((BMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1020)((CMAT(J,K),J=1,NOR),K=1,NOR)
      WRITE (6,1010)
      WRITE (6,1010)
      WRITE (6,1020)DELTA
      STOP
      END
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